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SEQUENCE LISTING

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<120> A METHOD FOR IMPROVING THE THERMOSTABILITY OF ALPH
A-GLUCAN PHOSPHORYLASE (GP)

<130> EG012PCT

<140> PCT/JP2004/008362

<141> 2004-06-15

<150> JP 2003-173972

<151> 2003-06-18

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<170> PatentIn version 3.3

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gaa ctg gag aaa gat gag cca gta cca gct cct ata cca ccc aag 1744
Glu Leu Glu Lys Asp Glu Asp Pro Val Pro Ala Pro Ile Pro Pro Lys
495 500 505 510

atg gtc cgc atg gct aat ctc tgc gtt ggt ggt cat gct gta aat 1792
Met Val Arg Met Ala Asn Leu Cys Val Val Gly Gly His Ala Val Asn
515 520 525

gga gtt gcc gag att cat agt gat ata gtg aag gaa gat gtt ttt aat 1840
Gly Val Ala Glu Ile His Ser Asp Ile Val Lys Glu Asp Val Phe Asn
530 535 540

gac ttt tac cag ctt tgg cct gag aaa ttt caa aac aaa aca aat ggt 1888
Asp Phe Tyr Gln Leu Trp Pro Glu Lys Phe Gln Asn Lys Thr Asn Gly
545 550 555

gtg aca cca aga aga tgg atc cga ttt tgt aat cct gct cta agt aat 1936
Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn Pro Ala Leu Ser Asn
560 565 570

atc att act aag tgg att ggt aca gag gac tgg gtc cta aac aca gaa 1984
Ile Ile Thr Lys Trp Ile Gly Thr Glu Asp Trp Val Leu Asn Thr Glu
575 580 585 590

aag ttg gca gaa ctg cgc aag ttt gca gat aat gaa gat ctt caa ata 2032

Lys Leu Ala Glu Leu Arg Lys Phe Ala Asp Asn Glu Asp Leu Gln Ile
595 600 605

gag tgg agg gct gca aaa aga agc aac aaa gtt aag gtt gcc tca ttc 2080
Glu Trp Arg Ala Ala Lys Arg Ser Asn Lys Val Lys Val Ala Ser Phe
610 615 620

cta aaa gaa agg aca ggg tat tcg gtc agc ccc aat gca atg ttt gat 2128
Leu Lys Glu Arg Thr Gly Tyr Ser Val Ser Pro Asn Ala Met Phe Asp
625 630 635

atc cag gta aaa cga att cat gaa tac aag cgc caa ctc ttg aat atc 2176
Ile Gln Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Ile
640 645 650

ttg gga att gtt tat cgc tac aag cag atg aaa gaa atg agc gca cga 2224
Leu Gly Ile Val Tyr Arg Tyr Lys Gln Met Lys Glu Met Ser Ala Arg
655 660 665 670

gaa aga gaa gct aag ttt gtt cct cga gta tgc ata ttt gga gga aaa 2272
Glu Arg Glu Ala Lys Phe Val Pro Arg Val Cys Ile Phe Gly Gly Lys
675 680 685

gct ttt gct aca tat gtt caa gct aaa agg atc gca aaa ttc ata aca 2320
Ala Phe Ala Thr Tyr Val Gln Ala Lys Arg Ile Ala Lys Phe Ile Thr
690 695 700

gat gtt gga gcc acc ata aac cat gat cct gag ata ggt gat ttg ttg 2368
Asp Val Gly Ala Thr Ile Asn His Asp Pro Glu Ile Gly Asp Leu Leu
705 710 715

aag gtt att ttt gtc cca gat tac aat gtc agt gct gca gaa ctg ctg 2416
Lys Val Ile Phe Val Pro Asp Tyr Asn Val Ser Ala Ala Glu Leu Leu
720 725 730

att cca gct agt gga ctt tca caa cat atc agt act gcc gga atg gag 2464
Ile Pro Ala Ser Gly Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu
735 740 745 750

gcc agt gga caa agc aat atg aaa ttt gcc atg aat ggt tgc atc tta 2512
Ala Ser Gly Gln Ser Asn Met Lys Phe Ala Met Asn Gly Cys Ile Leu
755 760 765

att ggg acc ttg gat gga gcc aat gtt gag ata agg caa gag gtt gga 2560
Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Gln Glu Val Gly
770 775 780

gag gaa aac ttc ttt ctc ttt ggg gct gaa gct cat gag att gca ggg 2608
Glu Glu Asn Phe Phe Leu Phe Gly Ala Glu Ala His Glu Ile Ala Gly
785 790 795

ctt cgg aaa gaa aga gct gag gga aag ttt gta cca gat gaa cgt ttt 2656
Leu Arg Lys Glu Arg Ala Glu Gly Lys Phe Val Pro Asp Glu Arg Phe
800 805 810

gag gaa gtc aag gaa ttc ata aag cgt ggt ttt ggc tcc aat acc 2704
Glu Glu Val Lys Glu Phe Ile Lys Arg Gly Val Phe Gly Ser Asn Thr
815 820 825 830

tat gat gag ctt ctt gga tct ttg gag gga aat gaa ggc ttt ggt cgt 2752

Tyr Asp Glu Leu Leu Gly Ser Leu Glu Gly Asn Glu Gly Phe Gly Arg
835 840 845

gga gac tat ttc ctt gtg ggc aag gac ttc cct agt tac ata gaa tgc 2800
Gly Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro Ser Tyr Ile Glu Cys
850 855 860

caa gag aag gtt gat gag gca tat cga gac caa aag ata tgg act aga 2848
Gln Glu Lys Val Asp Glu Ala Tyr Arg Asp Gln Lys Ile Trp Thr Arg
865 870 875

atg tca atc ttg aac aca gcc gga agt tac aaa ttc agc agt gat aga 2896
Met Ser Ile Leu Asn Thr Ala Gly Ser Tyr Lys Phe Ser Ser Asp Arg
880 885 890

aca att cat gaa tat gcc aag gac ata tgg aac atc cag cca gtt gtg 2944
Thr Ile His Glu Tyr Ala Lys Asp Ile Trp Asn Ile Gln Pro Val Val
895 900 905 910

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Phe Pro

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-10 -5 -1 1 5

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Thr Leu Leu Asp Ala Ala Ser Ile Ala Ser Ser Ile Lys Tyr His Ala
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Glu Phe Ser Pro Ala Phe Ser Pro Glu Arg Phe Glu Leu Pro Lys Ala
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Tyr Phe Ala Thr Ala Gln Ser Val Arg Asp Ala Leu Ile Val Asn Trp
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Asn Ala Thr Tyr Asp Tyr Tyr Glu Lys Leu Asn Met Lys Gln Ala Tyr
70 75 80 85

Tyr Leu Ser Met Glu Phe Leu Gln Gly Arg Ala Leu Leu Asn Ala Ile
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Gly Asn Leu Glu Leu Thr Gly Glu Tyr Ala Glu Ala Leu Asn Lys Leu
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Gly His Asn Leu Glu Asn Val Ala Ser Lys Glu Pro Asp Ala Ala Leu
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Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu Asp Ser Leu
135 140 145

Ala Thr Leu Asn Tyr Pro Ala Trp Gly Tyr Gly Leu Arg Tyr Lys Tyr
150 155 160 165

Gly Leu Phe Lys Gln Arg Ile Thr Lys Asp Gly Gln Glu Glu Val Ala
170 175 180

Glu Asp Trp Leu Glu Leu Gly Asn Pro Trp Glu Ile Ile Arg Met Asp
185 190 195

Val Ser Tyr Pro Val Lys Phe Phe Gly Lys Val Ile Thr Gly Ser Asp
200 205 210

Gly Lys Lys His Trp Ile Gly Gly Glu Asp Ile Leu Ala Val Ala Tyr
215 220 225

Asp Val Pro Ile Pro Gly Tyr Lys Thr Arg Thr Thr Ile Ser Leu Arg
230 235 240 245

Leu Trp Ser Thr Lys Val Pro Ser Glu Asp Phe Asp Leu Tyr Ser Phe
250 255 260

Asn Ala Gly Glu His Thr Lys Ala Cys Glu Ala Gln Ala Asn Ala Glu
265 270 275

Lys Ile Cys Tyr Ile Leu Tyr Pro Gly Asp Glu Ser Ile Glu Gly Lys
280 285 290

Ile Leu Arg Leu Lys Gln Gln Tyr Thr Leu Cys Ser Ala Ser Leu Gln
295 300 305

Asp Ile Ile Ala Arg Phe Glu Arg Arg Ser Gly Glu Tyr Val Lys Trp
310 315 320 325

Glu Glu Phe Pro Glu Lys Val Ala Val Gln Met Asn Asp Thr His Pro
330 335 340

Thr Leu Cys Ile Pro Glu Leu Ile Arg Ile Leu Ile Asp Leu Lys Gly
345 350 355

Leu Ser Trp Lys Glu Ala Trp Asn Ile Thr Gln Arg Thr Val Ala Tyr
360 365 370

Thr Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Tyr Glu
375 380 385

Leu Met Glu Lys Leu Leu Pro Arg His Ile Glu Ile Ile Glu Met Ile
390 395 400 405

Asp Glu Gln Leu Ile Asn Glu Ile Val Ser Glu Tyr Gly Thr Ser Asp
410 415 420

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425 430 435

Phe Asp Ile Pro Ser Ser Ile Ala Asn Leu Phe Thr Lys Pro Lys Glu
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Thr Ser Ile Val Asp Pro Ser Glu Glu Val Glu Val Ser Gly Lys Val
455 460 465

Val Thr Glu Ser Val Glu Val Ser Asp Lys Val Val Thr Glu Ser Glu
470 475 480 485

Lys Asp Glu Leu Glu Glu Lys Asp Thr Glu Leu Glu Lys Asp Glu Asp
490 495 500

Pro Val Pro Ala Pro Ile Pro Pro Lys Met Val Arg Met Ala Asn Leu
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Cys Val Val Gly Gly His Ala Val Asn Gly Val Ala Glu Ile His Ser
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Asp Ile Val Lys Glu Asp Val Phe Asn Asp Phe Tyr Gln Leu Trp Pro
535 540 545

Glu Lys Phe Gln Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile
550 555 560 565

Arg Phe Cys Asn Pro Ala Leu Ser Asn Ile Ile Thr Lys Trp Ile Gly
570 575 580

Thr Glu Asp Trp Val Leu Asn Thr Glu Lys Leu Ala Glu Leu Arg Lys
585 590 595

Phe Ala Asp Asn Glu Asp Leu Gln Ile Glu Trp Arg Ala Ala Lys Arg
600 605 610

Ser Asn Lys Val Lys Val Ala Ser Phe Leu Lys Glu Arg Thr Gly Tyr
615 620 625

Ser Val Ser Pro Asn Ala Met Phe Asp Ile Gln Val Lys Arg Ile His
630 635 640 645

Glu Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly Ile Val Tyr Arg Tyr
650 655 660

Lys Gln Met Lys Glu Met Ser Ala Arg Glu Arg Glu Ala Lys Phe Val
665 670 675

Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln
680 685 690

Ala Lys Arg Ile Ala Lys Phe Ile Thr Asp Val Gly Ala Thr Ile Asn
695 700 705

His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val Ile Phe Val Pro Asp
710 715 720 725

Tyr Asn Val Ser Ala Ala Glu Leu Leu Ile Pro Ala Ser Gly Leu Ser
730 735 740

Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Gln Ser Asn Met
745 750 755

Lys Phe Ala Met Asn Gly Cys Ile Leu Ile Gly Thr Leu Asp Gly Ala
760 765 770

Asn Val Glu Ile Arg Gln Glu Val Gly Glu Glu Asn Phe Phe Leu Phe
775 780 785

Gly Ala Glu Ala His Glu Ile Ala Gly Leu Arg Lys Glu Arg Ala Glu
790 795 800 805

Gly Lys Phe Val Pro Asp Glu Arg Phe Glu Glu Val Lys Glu Phe Ile
810 815 820

Lys Arg Gly Val Phe Gly Ser Asn Thr Tyr Asp Glu Leu Leu Gly Ser
825 830 835

Leu Glu Gly Asn Glu Gly Phe Gly Arg Gly Asp Tyr Phe Leu Val Gly
840 845 850

Lys Asp Phe Pro Ser Tyr Ile Glu Cys Gln Glu Lys Val Asp Glu Ala
855 860 865

Tyr Arg Asp Gln Lys Ile Trp Thr Arg Met Ser Ile Leu Asn Thr Ala
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-70	-65	-60													
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-40	-35	-30	-25												
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Val	Phe	Gln	Pro	Asp	Ser	Thr	Ser	Val	Leu	Ser	Ser	Ile	Lys	Tyr	His
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Ala	Glu	Phe	Thr	Pro	Ser	Phe	Ser	Pro	Glu	Phe	Glu	Leu	Pro	Lys	
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gca tac tat gca act gca gag agt gtt cga gat acg ctc att ata aat 449															
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tgg aat gcc aca tac gaa ttc tat gaa aag atg aat gta aag cag gca 497															
Trp	Asn	Ala	Thr	Tyr	Glu	Phe	Tyr	Glu	Met	Asn	Val	Lys	Gln	Ala	
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75	80	85													
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Leu	Gly	Asn	Gly	Gly	Leu	Gly	Arg	Leu	Ala	Ser	Cys	Phe	Leu	Asp	Ser
105	110	115	120												
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Met	Ala	Thr	Leu	Asn	Tyr	Pro	Ala	Trp	Gly	Tyr	Gly	Leu	Arg	Tyr	Gln
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Tyr	Gly	Leu	Phe	Lys	Gln	Leu	Ile	Thr	Lys	Asp	Gly	Gln	Glu	Glu	Val
140	145	150													
gct gaa aat tgg ctc gag atg gga aat cca tgg gaa att gtg agg aat 833															
Ala	Glu	Asn	Trp	Leu	Glu	Met	Gly	Asn	Pro	Trp	Glu	Ile	Val	Arg	Asn

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Asp Ile Ser Tyr Pro Val Lys Phe Tyr Gly Lys Val Ile Glu Gly Ala			
170	175	180	
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185	190	195	200
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Tyr Asp Val Pro Ile Pro Gly Tyr Lys Thr Lys Thr Ile Asn Leu			
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cga ttg tgg aca aca aag cta gct gca gaa gct ttt gat tta tat gct 1025			
Arg Leu Trp Thr Lys Leu Ala Ala Glu Ala Phe Asp Leu Tyr Ala			
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Phe Asn Asn Gly Asp His Ala Lys Ala Tyr Glu Ala Gln Lys Lys Ala			
235	240	245	
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Lys Thr Leu Arg Leu Lys Gln Gln Tyr Thr Leu Cys Ser Ala Ser Leu			
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Gln Asp Ile Ile Ala Arg Phe Glu Lys Arg Ser Gly Asn Ala Val Asn			
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Pro Thr Leu Cys Ile Pro Glu Leu Leu Arg Ile Leu Met Asp Val Lys			
315	320	325	
ggt ttg agc tgg aag cag gca tgg gaa att act caa aga acg gtc gca 1361			
Gly Leu Ser Trp Lys Gln Ala Trp Glu Ile Thr Gln Arg Thr Val Ala			
330	335	340	
tac act aac cac act gtt cta cct gag gct ctt gag aaa tgg agc ttc 1409			
Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Phe			
345	350	355	360
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365	370	375	
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380	385	390	
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395

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 425 430 435 440

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 445 450 455

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 505 510 515 520

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 555 560 565

aac act gaa aaa ttg gca gag ctt cga aag ttt gct gat aac gaa gaa 2081
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 570 575 580

ctc cag tct gag tgg agg aag gca aaa gga aat aac aaa atg aag att 2129
 Leu Gln Ser Glu Trp Arg Lys Ala Lys Gly Asn Asn Lys Met Lys Ile
 585 590 595 600

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 Val Ser Leu Ile Lys Glu Lys Thr Gly Tyr Val Val Ser Pro Asp Ala
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 620 625 630

tta aat ata ttt gga atc gtt tat cgc tat aag aag atg aaa gaa atg 2273
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635

640

645

agc cct gaa gaa cga aaa gaa aag ttt gtc cct cga gtt tgc ata ttt 2321
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 665 670 675 680

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 685 690 695

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 700 705 710

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 715 720 725

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 730 735 740

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 745 750 755 760

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 765 770 775

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 780 785 790

cca aga ttt gaa gaa gta aag gcg ttc att agg aca ggc gtc ttt ggc 2753
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 795 800 805

acc tac aac tat gaa gaa ctc atg gca tcc ttg gaa gga aac gaa ggc 2801
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 810 815 820

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 Tyr Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro Asp Tyr
 825 830 835 840

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 845 850 855

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 Trp Thr Lys Met Ser Ile Leu Asn Thr Ala Gly Ser Phe Lys Phe Ser
 860 865 870

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875

880

885

cct gtt gaa tta cct taaaagtttag ccagttaaag gatgaaagcc aatttttcc 3048
Pro Val Glu Leu Pro
890

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-65 -60 -55 -50

Arg Arg Arg Ile Leu Leu Phe Ser Phe Arg Arg Arg Arg Arg Ser Phe
-45 -40 -35

Ser Val Ser Ser Val Ala Ser Asp Gln Lys Gln Lys Thr Lys Asp Ser
-30 -25 -20

Ser Ser Asp Glu Gly Phe Thr Leu Asp Val Phe Gln Pro Asp Ser Thr
-15 -10 -5

Ser Val Leu Ser Ser Ile Lys Tyr His Ala Glu Phe Thr Pro Ser Phe
-1 1 5 10 15

Ser Pro Glu Lys Phe Glu Leu Pro Lys Ala Tyr Tyr Ala Thr Ala Glu
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Ser Val Arg Asp Thr Leu Ile Ile Asn Trp Asn Ala Thr Tyr Glu Phe
35 40 45

Tyr Glu Lys Met Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe
50 55 60

Leu Gln Gly Arg Ala Leu Leu Asn Ala Ile Gly Asn Leu Gly Leu Thr
65 70 75

Gly Pro Tyr Ala Asp Ala Leu Thr Lys Leu Gly Tyr Ser Leu Glu Asp
80 85 90 95

Val Ala Arg Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly
100 105 110

Arg Leu Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Tyr Pro
115 120 125

Ala Trp Gly Tyr Gly Leu Arg Tyr Gln Tyr Gly Leu Phe Lys Gln Leu
130 135 140

Ile Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asn Trp Leu Glu Met
145 150 155

Gly Asn Pro Trp Glu Ile Val Arg Asn Asp Ile Ser Tyr Pro Val Lys
160 165 170 175

Phe Tyr Gly Lys Val Ile Glu Gly Ala Asp Gly Arg Lys Glu Trp Ala
180 185 190

Gly Gly Glu Asp Ile Thr Ala Val Ala Tyr Asp Val Pro Ile Pro Gly
195 200 205

Tyr Lys Thr Lys Thr Thr Ile Asn Leu Arg Leu Trp Thr Thr Lys Leu
210 215 220

Ala Ala Glu Ala Phe Asp Leu Tyr Ala Phe Asn Asn Gly Asp His Ala
225 230 235

Lys Ala Tyr Glu Ala Gln Lys Lys Ala Glu Lys Ile Cys Tyr Val Leu
240 245 250 255

Tyr Pro Gly Asp Glu Ser Leu Glu Gly Lys Thr Leu Arg Leu Lys Gln
260 265 270

Gln Tyr Thr Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe
275 280 285

Glu Lys Arg Ser Gly Asn Ala Val Asn Trp Asp Gln Phe Pro Glu Lys
290 295 300

Val Ala Val Gln Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu
305 310 315

Leu Leu Arg Ile Leu Met Asp Val Lys Gly Leu Ser Trp Lys Gln Ala
320 325 330 335

Trp Glu Ile Thr Gln Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu
340 345 350

Pro Glu Ala Leu Glu Lys Trp Ser Phe Thr Leu Leu Gly Glu Leu Leu
355 360 365

Pro Arg His Val Glu Ile Ile Ala Met Ile Asp Glu Glu Leu Leu His
370 375 380

Thr Ile Leu Ala Glu Tyr Gly Thr Glu Asp Leu Asp Leu Leu Gln Glu
385 390 395

Lys Leu Asn Gln Met Arg Ile Leu Asp Asn Val Glu Ile Pro Ser Ser
400 405 410 415

Val Leu Glu Leu Leu Ile Lys Ala Glu Glu Ser Ala Ala Asp Val Glu
420 425 430

Lys Ala Ala Asp Glu Glu Gln Glu Glu Gly Lys Asp Asp Ser Lys
435 440 445

Asp Glu Glu Thr Glu Ala Val Lys Ala Glu Thr Thr Asn Glu Glu Glu
450 455 460

Glu Thr Glu Val Lys Lys Val Glu Val Glu Asp Ser Gln Ala Lys Ile
465 470 475

Lys Arg Ile Phe Gly Pro His Pro Asn Lys Pro Gln Val Val His Met
480 485 490 495

Ala Asn Leu Cys Val Val Ser Gly His Ala Val Asn Gly Val Ala Glu
500 505 510

Ile His Ser Glu Ile Val Lys Asp Glu Val Phe Asn Glu Phe Tyr Lys
515 520 525

Leu Trp Pro Glu Lys Phe Gln Asn Lys Thr Asn Gly Val Thr Pro Arg
530 535 540

Arg Trp Leu Ser Phe Cys Asn Pro Glu Leu Ser Glu Ile Ile Thr Lys
545 550 555

Trp Thr Gly Ser Asp Asp Trp Leu Val Asn Thr Glu Lys Leu Ala Glu
560 565 570 575

Leu Arg Lys Phe Ala Asp Asn Glu Glu Leu Gln Ser Glu Trp Arg Lys
580 585 590

Ala Lys Gly Asn Asn Lys Met Lys Ile Val Ser Leu Ile Lys Glu Lys
595 600 605

Thr Gly Tyr Val Val Ser Pro Asp Ala Met Phe Asp Val Gln Ile Lys
610 615 620

Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Ile Phe Gly Ile Val
625 630 635

Tyr Arg Tyr Lys Lys Met Lys Glu Met Ser Pro Glu Glu Arg Lys Glu
640 645 650 655

Lys Phe Val Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe Ala Thr
660 665 670

Tyr Val Gln Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val Gly Glu
675 680 685

Thr Val Asn His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val Val Phe
690 695 700

Val Pro Asp Tyr Asn Val Ser Val Ala Glu Val Leu Ile Pro Gly Ser
705 710 715

Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr
720 725 730 735

Ser Asn Met Lys Phe Ser Met Asn Gly Cys Leu Leu Ile Gly Thr Leu
740 745 750

Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Val Gly Glu Asp Asn Phe
755 760 765

Phe Leu Phe Gly Ala Gln Ala His Glu Ile Ala Gly Leu Arg Lys Glu
770 775 780

Arg Ala Glu Gly Lys Phe Val Pro Asp Pro Arg Phe Glu Glu Val Lys
785 790 795

Ala Phe Ile Arg Thr Gly Val Phe Gly Thr Tyr Asn Tyr Glu Glu Leu
800 805 810 815

Met Gly Ser Leu Glu Gly Asn Glu Gly Tyr Gly Arg Ala Asp Tyr Phe
820 825 830

Leu Val Gly Lys Asp Phe Pro Asp Tyr Ile Glu Cys Gln Asp Lys Val
835 840 845

Asp Glu Ala Tyr Arg Asp Gln Lys Lys Trp Thr Lys Met Ser Ile Leu
850 855 860

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Glu Ser Val Pro Arg Arg Gly Ser Val Tyr Gly Phe Ile Gly Tyr Arg
-45 -40 -35

tcc tcg tcg ttg ttc gtc cga acg aac gtt atc aag tat cgt tct gtt 201
Ser Ser Ser Leu Phe Val Arg Thr Asn Val Ile Lys Tyr Arg Ser Val
-30 -25 -20

aag cgt aat ctg gaa ttt agg agg aga agc gct ttc tct gtg aag tgt 249
Lys Arg Asn Leu Glu Phe Arg Arg Arg Ser Ala Phe Ser Val Lys Cys
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Gly Ser Gly Asn Glu Ala Lys Gln Lys Val Lys Asp Gln Glu Val Gln
1 5 10 15

caa gaa gct aaa act tct ccg agc tca ttt gca cca gat act act tcc 345
 Gln Glu Ala Lys Thr Ser Pro Ser Ser Phe Ala Pro Asp Thr Thr Ser
 20 25 30

att gtg tca agt att aag tac cat gca gag ttc aca cca ctg ttt tct 393
 Ile Val Ser Ser Ile Lys Tyr His Ala Glu Phe Thr Pro Leu Phe Ser
 35 40 45

ccg gaa aaa ttt gag ctt cca caa gct ttc att gca act gca cag agt 441
 Pro Glu Lys Phe Glu Leu Pro Gln Ala Phe Ile Ala Thr Ala Gln Ser
 50 55 60

gtt cgt gat gct ctc ata ata aac tgg aat gct act tat gat tac tat 489
 Val Arg Asp Ala Leu Ile Ile Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr
 65 70 75 80

gag aag ctg aat gtt aag cag gca tat tac ctt tca atg gaa ttt tta 537
 Glu Lys Leu Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu
 85 90 95

cag gga aga gca tta ttg aat gca att ggc aat tta gag cta act ggt 585
 Gln Gly Arg Ala Leu Leu Asn Ala Ile Gly Asn Leu Glu Leu Thr Gly
 100 105 110

ccc tat gca gag gct ttg agc cag ctt agt tat aaa tta gaa gac gtg 633
 Pro Tyr Ala Glu Ala Leu Ser Gln Leu Ser Tyr Lys Leu Glu Asp Val
 115 120 125

gca cac cag gag ccg gat gct gca ctt gga aat ggg ggt ctt gga cga 681
 Ala His Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg
 130 135 140

ctt gct tca tgt ttc ttg gac tct ttg gct acc ttg aat tat ccg gca 729
 Leu Ala Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala
 145 150 155 160

tgg ggt tat gga ctg aga tac aag tat ggc tta ttc aaa caa cga atc 777
 Trp Gly Tyr Gly Leu Arg Tyr Lys Tyr Gly Leu Phe Lys Gln Arg Ile
 165 170 175

acc aaa gat ggg caa gag gaa gtt gct gaa gat tgg ctc gag atg ggc 825
 Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Met Gly
 180 185 190

aat cct tgg gag atc gtt aga aat gac gtc tca tac cct gta agg ttc 873
 Asn Pro Trp Glu Ile Val Arg Asn Asp Val Ser Tyr Pro Val Arg Phe
 195 200 205

tat ggc aaa gtt gtt tca ggc tca gat ggt aaa aaa cat tgg gtt gga 921
 Tyr Gly Lys Val Val Ser Gly Ser Asp Gly Lys Lys His Trp Val Gly
 210 215 220

gga gaa gat atc aaa gct gtt gca cac gat gtc ccc ata ccc gga tat 969
 Gly Glu Asp Ile Lys Ala Val Ala His Asp Val Pro Ile Pro Gly Tyr
 225 230 235 240

aag acc aga agc aca att aac ctg aga ctt tgg tct aca aaa gct gca 1017
 Lys Thr Arg Ser Thr Ile Asn Leu Arg Leu Trp Ser Thr Lys Ala Ala
 245 250 255

tcc gaa gaa ttt gat tta aat gct ttt aat tct gga agg cac acc gaa 1065
 Ser Glu Glu Phe Asp Leu Asn Ala Phe Asn Ser Gly Arg His Thr Glu
 260 265 270

gca tct gag gct cta gca aat gct gaa aag att tgc tat ata ctt tac 1113
 Ala Ser Glu Ala Leu Ala Asn Ala Glu Lys Ile Cys Tyr Ile Leu Tyr
 275 280 285

ccc ggg gat gaa tct ata gag gga aaa acc ctt cgc ctc aag caa caa 1161
 Pro Gly Asp Glu Ser Ile Glu Gly Lys Thr Leu Arg Leu Lys Gln Gln
 290 295 300

tat act tta tgt tcg gct tct ctt caa gat atc att gct cgt ttt gag 1209
 Tyr Thr Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe Glu
 305 310 315 320

aga aga tca ggg gca agt gtg aat tgg gaa gac ttt cct gaa aag gtt 1257
 Arg Arg Ser Gly Ala Ser Val Asn Trp Glu Asp Phe Pro Glu Lys Val
 325 330 335

gca gtg cag atg aat gat act cac cca act ttg tgc atc cca gag ctg 1305
 Ala Val Gln Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu
 340 345 350

atg aga atc ctg ata gat ata aag ggt tta agc tgg aag gat gct tgg 1353
 Met Arg Ile Leu Ile Asp Ile Lys Gly Leu Ser Trp Lys Asp Ala Trp
 355 360 365

aat atc acc caa cgg act gta gca tac aca aac cat act gtt ctt ccg 1401
 Asn Ile Thr Gln Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro
 370 375 380

gag gca tta gag aaa tgg agc atg gac ctt atg gag aaa ttg ctt cca 1449
 Glu Ala Leu Glu Lys Trp Ser Met Asp Leu Met Glu Lys Leu Leu Pro
 385 390 395 400

cgc cat gtt gag att ata gaa atg att gat gag gag ctg att ccg acc 1497
 Arg His Val Glu Ile Ile Glu Met Ile Asp Glu Glu Leu Ile Arg Thr
 405 410 415

ata atc gca gaa tat ggc aca gca gat tca gac tta ctt gat aag aaa 1545
 Ile Ile Ala Glu Tyr Gly Thr Ala Asp Ser Asp Leu Leu Asp Lys Lys
 420 425 430

ttg aag gaa atg aga ata cta gaa aat gtt gaa ttg cct gca gaa ttt 1593
 Leu Lys Glu Met Arg Ile Leu Glu Asn Val Glu Leu Pro Ala Glu Phe
 435 440 445

gca gat ata cta gtt aaa acc aag gag gcc act gat att tct agt gag 1641
 Ala Asp Ile Leu Val Lys Thr Lys Glu Ala Thr Asp Ile Ser Ser Glu
 450 455 460

gaa gtg caa att tct aaa gaa ggg gga gaa gaa gaa act tct aaa 1689
 Glu Val Gln Ile Ser Lys Glu Gly Gly Glu Glu Glu Thr Ser Lys
 465 470 475 480

gaa ggg gga gaa gaa gaa gaa aaa gaa gta gga gga gga aga gaa 1737
 Glu Gly Gly Glu Glu Glu Glu Lys Glu Val Gly Gly Gly Arg Glu
 485 490 495

gaa ggc gat gat ggt aag gaa gat gaa gtg gaa aaa gca att gct gaa 1785
 Glu Gly Asp Asp Gly Lys Glu Asp Glu Val Glu Lys Ala Ile Ala Glu
 500 505 510

aag gat gga acg gtt aaa agc tcc att ggg gat aag aaa aag aag ttg 1833
 Lys Asp Gly Thr Val Lys Ser Ser Ile Gly Asp Lys Lys Lys Leu
 515 520 525

cct gag cca gta cca gta ccg cca aaa ttg gtt cgt atg gcc aat ctt 1881
 Pro Glu Pro Val Pro Val Pro Lys Leu Val Arg Met Ala Asn Leu
 530 535 540

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 Cys Val Val Gly Gly His Ala Val Asn Gly Val Ala Glu Ile His Ser
 545 550 555 560

gaa att gtc aag gat gac gtg ttc aat gca ttt tat aag ttg tgg cct 1977
 Glu Ile Val Lys Asp Asp Val Phe Asn Ala Phe Tyr Lys Leu Trp Pro
 565 570 575

gag aaa ttc cag aac aaa aca aat ggc gtg acg cct agg aga tgg att 2025
 Glu Lys Phe Gln Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile
 580 585 590

agg ttc tgc aat cca gat ttg agt aaa ata ata act cag tgg ata ggc 2073
 Arg Phe Cys Asn Pro Asp Leu Ser Lys Ile Ile Thr Gln Trp Ile Gly
 595 600 605

aca gaa gac tgg atc cta aat act gag aaa ctg gct gaa ctg cgg aag 2121
 Thr Glu Asp Trp Ile Leu Asn Thr Glu Lys Leu Ala Glu Leu Arg Lys
 610 615 620

ttt gca gat aat gag gat ctg caa aca caa tgg agg gaa gca aaa agg 2169
 Phe Ala Asp Asn Glu Asp Leu Gln Thr Gln Trp Arg Glu Ala Lys Arg
 625 630 635 640

aat aac aag gtg aaa gtt gca gca ttc ctc aga gaa aga aca gga tat 2217
 Asn Asn Lys Val Lys Val Ala Ala Phe Leu Arg Glu Arg Thr Gly Tyr
 645 650 655

tct gtc agt cct gat tca atg ttt gac atc cag gtg aaa aga atc cat 2265
 Ser Val Ser Pro Asp Ser Met Phe Asp Ile Gln Val Lys Arg Ile His
 660 665 670

gaa tat aaa cga caa tta tta aat ata ttt gga att gtt tat cgc tac 2313
 Glu Tyr Lys Arg Gln Leu Leu Asn Ile Phe Gly Ile Val Tyr Arg Tyr
 675 680 685

aag aag atg aaa gaa atg aat gct gct gaa aga aaa gaa aat ttt gtt 2361
 Lys Lys Met Lys Glu Met Asn Ala Ala Glu Arg Lys Glu Asn Phe Val
 690 695 700

cca aga gtt tgt ata ttt ggg gga aaa gca ttt gct act tat gtg caa 2409
 Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln
 705 710 715 720

gcc aaa aga att gtg aaa ttt att aca gat gtt gga gct act gta aat 2457
 Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val Gly Ala Thr Val Asn
 725 730 735

cat gat cca gaa ata gga gat ctt ctt aag gtt att ttt gtc cct gac 2505
His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val Ile Phe Val Pro Asp
740 745 750

tac aat gtt agt gtt gcg gag atg ctt att cct gct agt gaa ttg tca 2553
Tyr Asn Val Ser Val Ala Glu Met Leu Ile Pro Ala Ser Glu Leu Ser
755 760 765

caa cat atc agt act gct gga atg gag gca agt gga act agc aac atg 2601
Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met
770 775 780

aaa ttt gca atg aat gga tgc tta cag att gga act ttg gat ggg gcc 2649
Lys Phe Ala Met Asn Gly Cys Leu Gln Ile Gly Thr Leu Asp Gly Ala
785 790 795 800

aat gtt gaa ata agg gaa gag gtt ggt gct gac aac ttc ttc ctt ttt 2697
Asn Val Glu Ile Arg Glu Glu Val Gly Ala Asp Asn Phe Phe Leu Phe
805 810 815

ggg gct aag gct cgt gaa att gtt ggg ctc agg aaa gaa aga gca aga 2745
Gly Ala Lys Ala Arg Glu Ile Val Gly Leu Arg Lys Glu Arg Ala Arg
820 825 830

ggg aag ttt gtc cct gat cca cga ttc gaa gaa gtt aaa aaa ttt gtc 2793
Gly Lys Phe Val Pro Asp Pro Arg Phe Glu Glu Val Lys Lys Phe Val
835 840 845

aga agt ggt gtc ttt ggg tct tac aac tat gat gaa ctg att gga tcc 2841
Arg Ser Gly Val Phe Gly Ser Tyr Asn Tyr Asp Glu Leu Ile Gly Ser
850 855 860

tta gaa gga aat gaa ggt ttt ggt cga gca gat tat ttt ctt gtg ggc 2889
Leu Glu Gly Asn Glu Gly Phe Gly Arg Ala Asp Tyr Phe Leu Val Gly
865 870 875 880

cag gac ttc cct agc tat tta gaa tgc cag gag gag gtc gac aaa gct 2937
Gln Asp Phe Pro Ser Tyr Leu Glu Cys Gln Glu Glu Val Asp Lys Ala
885 890 895

tat cgc gac caa aaa aaa tgg aca aga atg tca ata ttg aac aca gca 2985
Tyr Arg Asp Gln Lys Lys Trp Thr Arg Met Ser Ile Leu Asn Thr Ala
900 905 910

ggc tca tcc aaa ttc agc agt gac cgt acc att cat gaa tat gca cga 3033
Gly Ser Ser Lys Phe Ser Ser Asp Arg Thr Ile His Glu Tyr Ala Arg
915 920 925

gaa ata tgg aac att gag cca gtc aaa ttg gag tagagggta atctatacta 3086
Glu Ile Trp Asn Ile Glu Pro Val Lys Leu Glu
930 935

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tacccattag tgaaaaataa actaagttt gtaaaaattaa aataagggtc tggtttaca 3206

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acaaggctac attcctg 3283

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<211> 1003
<212> PRT
<213> Vicia faba

<400> 8

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Glu Ser Val Pro Arg Arg Gly Ser Val Tyr Gly Phe Ile Gly Tyr Arg
-45 -40 -35

Ser Ser Ser Leu Phe Val Arg Thr Asn Val Ile Lys Tyr Arg Ser Val
-30 -25 -20

Lys Arg Asn Leu Glu Phe Arg Arg Arg Ser Ala Phe Ser Val Lys Cys
-15 -10 -5 -1

Gly Ser Gly Asn Glu Ala Lys Gln Lys Val Lys Asp Gln Glu Val Gln
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Gln Glu Ala Lys Thr Ser Pro Ser Ser Phe Ala Pro Asp Thr Thr Ser
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Ile Val Ser Ser Ile Lys Tyr His Ala Glu Phe Thr Pro Leu Phe Ser
35 40 45

Pro Glu Lys Phe Glu Leu Pro Gln Ala Phe Ile Ala Thr Ala Gln Ser
50 55 60

Val Arg Asp Ala Leu Ile Ile Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr
65 70 75 80

Glu Lys Leu Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu
85 90 95

Gln Gly Arg Ala Leu Leu Asn Ala Ile Gly Asn Leu Glu Leu Thr Gly
100 105 110

Pro Tyr Ala Glu Ala Leu Ser Gln Leu Ser Tyr Lys Leu Glu Asp Val
115 120 125

Ala His Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg
130 135 140

Leu Ala Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala
145 150 155 160

Trp Gly Tyr Gly Leu Arg Tyr Lys Tyr Gly Leu Phe Lys Gln Arg Ile
165 170 175

Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Met Gly
180 185 190

Asn Pro Trp Glu Ile Val Arg Asn Asp Val Ser Tyr Pro Val Arg Phe
195 200 205

Tyr Gly Lys Val Val Ser Gly Ser Asp Gly Lys Lys His Trp Val Gly
210 215 220

Gly Glu Asp Ile Lys Ala Val Ala His Asp Val Pro Ile Pro Gly Tyr
225 230 235 240

Lys Thr Arg Ser Thr Ile Asn Leu Arg Leu Trp Ser Thr Lys Ala Ala
245 250 255

Ser Glu Glu Phe Asp Leu Asn Ala Phe Asn Ser Gly Arg His Thr Glu
260 265 270

Ala Ser Glu Ala Leu Ala Asn Ala Glu Lys Ile Cys Tyr Ile Leu Tyr
275 280 285

Pro Gly Asp Glu Ser Ile Glu Gly Lys Thr Leu Arg Leu Lys Gln Gln
290 295 300

Tyr Thr Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe Glu
305 310 315 320

Arg Arg Ser Gly Ala Ser Val Asn Trp Glu Asp Phe Pro Glu Lys Val
325 330 335

Ala Val Gln Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu
340 345 350

Met Arg Ile Leu Ile Asp Ile Lys Gly Leu Ser Trp Lys Asp Ala Trp
355 360 365

Asn Ile Thr Gln Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro
370 375 380

Glu Ala Leu Glu Lys Trp Ser Met Asp Leu Met Glu Lys Leu Leu Pro
385 390 395 400

Arg His Val Glu Ile Ile Glu Met Ile Asp Glu Glu Leu Ile Arg Thr
405 410 415

Ile Ile Ala Glu Tyr Gly Thr Ala Asp Ser Asp Leu Leu Asp Lys Lys
420 425 430

Leu Lys Glu Met Arg Ile Leu Glu Asn Val Glu Leu Pro Ala Glu Phe
435 440 445

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Glu Val Gln Ile Ser Lys Glu Gly Gly Glu Glu Glu Thr Ser Lys
465 470 475 480

Glu Gly Gly Glu Glu Glu Glu Lys Glu Val Gly Gly Arg Glu
485 490 495

Glu Gly Asp Asp Gly Lys Glu Asp Glu Val Glu Lys Ala Ile Ala Glu
500 505 510

Lys Asp Gly Thr Val Lys Ser Ser Ile Gly Asp Lys Lys Lys Leu
515 520 525

Pro Glu Pro Val Pro Val Pro Pro Lys Leu Val Arg Met Ala Asn Leu
530 535 540

Cys Val Val Gly Gly His Ala Val Asn Gly Val Ala Glu Ile His Ser
545 550 555 560

Glu Ile Val Lys Asp Asp Val Phe Asn Ala Phe Tyr Lys Leu Trp Pro
565 570 575

Glu Lys Phe Gln Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile
580 585 590

Arg Phe Cys Asn Pro Asp Leu Ser Lys Ile Ile Thr Gln Trp Ile Gly
595 600 605

Thr Glu Asp Trp Ile Leu Asn Thr Glu Lys Leu Ala Glu Leu Arg Lys
610 615 620

Phe Ala Asp Asn Glu Asp Leu Gln Thr Gln Trp Arg Glu Ala Lys Arg
625 630 635 640

Asn Asn Lys Val Lys Val Ala Ala Phe Leu Arg Glu Arg Thr Gly Tyr
645 650 655

Ser Val Ser Pro Asp Ser Met Phe Asp Ile Gln Val Lys Arg Ile His
660 665 670

Glu Tyr Lys Arg Gln Leu Leu Asn Ile Phe Gly Ile Val Tyr Arg Tyr
675 680 685

Lys Lys Met Lys Glu Met Asn Ala Ala Glu Arg Lys Glu Asn Phe Val
690 695 700

Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln
705 710 715 720

Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val Gly Ala Thr Val Asn
725 730 735

His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val Ile Phe Val Pro Asp
740 745 750

Tyr Asn Val Ser Val Ala Glu Met Leu Ile Pro Ala Ser Glu Leu Ser
755 760 765

Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met
770 775 780

Lys Phe Ala Met Asn Gly Cys Leu Gln Ile Gly Thr Leu Asp Gly Ala
785 790 795 800

Asn Val Glu Ile Arg Glu Glu Val Gly Ala Asp Asn Phe Phe Leu Phe
805 810 815

Gly Ala Lys Ala Arg Glu Ile Val Gly Leu Arg Lys Glu Arg Ala Arg
820 825 830

Gly Lys Phe Val Pro Asp Pro Arg Phe Glu Glu Val Lys Lys Phe Val
835 840 845

Arg Ser Gly Val Phe Gly Ser Tyr Asn Tyr Asp Glu Leu Ile Gly Ser
850 855 860

Leu Glu Gly Asn Glu Gly Phe Gly Arg Ala Asp Tyr Phe Leu Val Gly
865 870 875 880

Gln Asp Phe Pro Ser Tyr Leu Glu Cys Gln Glu Val Asp Lys Ala
885 890 895

Tyr Arg Asp Gln Lys Trp Thr Arg Met Ser Ile Leu Asn Thr Ala
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Ile Gln Cys Asn Ser Leu Ser Ser Leu Val Ser Arg Arg Cys Asp Asp
20 25 30

gga aaa tgg cga acg aga atg ttt ccg gcg aga aac aga gac ttg cgt 144
Gly Lys Trp Arg Thr Arg Met Phe Pro Ala Arg Asn Arg Asp Leu Arg
35 40 45

cca tcg ccg acg aga aga tcc ttt ttg tcg gtg aaa tct atc tct agc 192
Pro Ser Pro Thr Arg Arg Ser Phe Leu Ser Val Lys Ser Ile Ser Ser
50 55 60

gaa ccg aaa gcc aaa gta acc gac gca gtt ctc gat tcc gaa caa gaa 240
Glu Pro Lys Ala Lys Val Thr Asp Ala Val Leu Asp Ser Glu Gln Glu
65 70 75 80

gtg ttt att agc tcg atg aat ccg ttt gcg cca gat gct gct tcg gta 288
Val Phe Ile Ser Ser Met Asn Pro Phe Ala Pro Asp Ala Ala Ser Val
85 90 95

gct tcg agt atc aag tac cac gcg gag ttt acg cca ttg ttt tca ccg 336
Ala Ser Ser Ile Lys Tyr His Ala Glu Phe Thr Pro Leu Phe Ser Pro
100 105 110

gag aag ttt gag ttg cca aag gcg ttc ttt gcg act gcg caa agt gtt 384
 Glu Lys Phe Glu Leu Pro Lys Ala Phe Phe Ala Thr Ala Gln Ser Val
 115 120 125

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805 810 815

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gtt gag att aga gaa gaa gtc gga gaa gat aac ttc ttt ctg ttt ggc 2603
Val Glu Ile Arg Glu Glu Val Gly Glu Asp Asn Phe Phe Leu Phe Gly
835 840 845

gct cga gca cat gat att gct ggc tta agg aag gaa aga gct gag ggc 2651
Ala Arg Ala His Asp Ile Ala Gly Leu Arg Lys Glu Arg Ala Glu Gly
850 855 860 865

aag tat gtg ccg gac cca tgt ttt gaa gaa gta aag gag tat gtt aga 2699
Lys Tyr Val Pro Asp Pro Cys Phe Glu Glu Val Lys Glu Tyr Val Arg
870 875 880

agt ggt gtc ttt ggt tca aac agt tat gat gaa ctg tta ggg tct tta 2747
Ser Gly Val Phe Gly Ser Asn Ser Tyr Asp Glu Leu Leu Gly Ser Leu
885 890 895

gag gga aat gaa gga ttt gga cgt gct gat tat ttc ctt gtg ggc aaa 2795
Glu Gly Asn Glu Gly Phe Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys
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Arg Asp Gln Gln Lys Trp Thr Arg Met Ser Ile Leu Asn Thr Ala Gly
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tca ttc aag ttt agc agc gac cga acg att cat caa tat gct aag gat 2939

Ser Phe Lys Phe Ser Ser Asp Arg Thr Ile His Gln Tyr Ala Lys Asp
950 955 960

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Ile Trp Asn Ile His Pro Val Asn Leu Pro
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35 40 45

Val Asn Tyr Lys Pro Met Ile Met Arg Gly Ser Arg Arg Cys Ile Val
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Ile Arg Asn Val Phe Ser Glu Ser Lys Pro Lys Ser Glu Glu Pro Ile
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Ile Glu Gln Glu Thr Pro Ser Ile Leu Asn Pro Leu Ser Asn Leu Ser
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Pro Asp Ser Ala Ser Arg Gln Ser Ser Ile Lys Tyr His Ala Glu Phe
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Thr Pro Leu Phe Ala Pro Asn Asp Phe Ser Leu Pro Lys Ala Phe Phe
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Ala Ala Ala Gln Ser Val Arg Asp Ser Leu Ile Ile Asn Trp Asn Ala
130 135 140

Thr Tyr Ala His Tyr Glu Lys Met Asn Met Lys Gln Ala Tyr Tyr Leu
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Ser Met Glu Phe Leu Gln Gly Arg Ala Leu Leu Asn Ala Ile Gly Asn

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Asn Leu Glu Ala Val Ala Cys Gln Glu Arg Asp Ala Ala Leu Gly Asn
195 200 205

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210 215 220

Leu Asn Tyr Pro Ala Trp Gly Tyr Gly Leu Arg Tyr Lys Tyr Gly Leu
225 230 235 240

Phe Lys Gln Met Ile Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asn
245 250 255

Trp Leu Glu Ile Ala Asn Pro Trp Glu Leu Val Arg Asn Asp Val Ser
260 265 270

Tyr Ser Ile Lys Phe Tyr Gly Lys Val Val Ser Gly Ser Asp Gly Arg
275 280 285

Ser His Trp Thr Gly Gly Glu Asp Ile Arg Ala Val Ala Tyr Asp Val
290 295 300

Pro Ile Pro Gly Tyr Gln Thr Lys Thr Thr Ile Asn Leu Arg Leu Trp
305 310 315 320

Cys Thr Thr Val Ser Ser Glu Asp Phe Asp Leu Ser Ala Phe Asn Ala
325 330 335

Gly Glu His Ala Lys Ala Asn Glu Ala Arg Ala Asn Ala Glu Lys Ile
340 345 350

Cys Ser Val Leu Tyr Pro Gly Asp Glu Ser Met Glu Gly Lys Ile Leu
355 360 365

Arg Leu Lys Gln Gln Tyr Thr Leu Cys Ser Ala Ser Leu Gln Asp Ile
370 375 380

Ile Ser Gln Phe Glu Arg Arg Ser Gly Glu His Val Asn Trp Glu Glu
385 390 395 400

Phe Pro Glu Lys Val Ala Val Gln Met Asn Asp Thr His Pro Thr Leu

405

410

415

Cys Ile Pro Glu Leu Met Arg Ile Leu Ile Asp Val Lys Gly Leu Ala
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Trp Lys Glu Ala Trp Asn Ile Thr Gln Arg Thr Val Ala Tyr Thr Asn
435 440 445

His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Phe Glu Leu Met
450 455 460

Gln Ser Leu Leu Pro Arg His Val Glu Ile Ile Glu Lys Ile Asp Glu
465 470 475 480

Glu Leu Val Asp Thr Ile Val Ser Glu Tyr Gly Thr Asp Asp Pro Lys
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Leu Pro Ser Ser Val Ala Ser Ile Ile Lys Asp Lys Ile Thr Cys Gln
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545 550 555 560

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565 570 575

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580 585 590

Gln Ile Val Lys Glu Gln Val Phe Arg Asp Phe Phe Glu Leu Trp Pro
595 600 605

Glu Lys Phe Gln Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile
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Arg Phe Cys Asn Pro Glu Leu Ser Ser Ile Leu Thr Lys Trp Ile Gly
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Ser Asp Asp Trp Val Leu Asn Thr Glu Lys Leu Ala Glu Leu Arg Lys

645

650

655

Phe Ala Asp Asn Lys Asp Leu His Thr Glu Trp Met Glu Ala Lys Arg
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675 680 685

Thr Val Ser Pro Asp Ala Met Phe Asp Ile Gln Ile Lys Arg Ile His
690 695 700

Glu Tyr Lys Arg Gln Leu Met Asn Ile Leu Gly Ile Val Tyr Arg Tyr
705 710 715 720

Lys Lys Met Lys Glu Met Ser Ala Ala Glu Arg Lys Glu Lys Tyr Val
725 730 735

Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln
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Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val Gly Ala Thr Ile Asn
755 760 765

His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val Val Phe Ile Pro Asp
770 775 780

Tyr Asn Val Ser Val Ala Glu Leu Leu Ile Pro Ala Ser Glu Leu Ser
785 790 795 800

Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met
805 810 815

Lys Phe Ser Met Asn Gly Cys Ile Leu Ile Gly Thr Leu Asp Gly Ala
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Gly Ala Arg Ala His Asp Ile Ala Gly Leu Arg Lys Glu Arg Ala Glu
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Arg Ser Gly Val Phe Gly Ser Asn Ser Tyr Asp Glu Leu Leu Gly Ser

885

890

895

Leu Glu Gly Asn Glu Gly Phe Gly Arg Ala Asp Tyr Phe Leu Val Gly
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Gln Arg Arg Val Ser Ala Arg Ser Val Ala Ser Asp Arg Asp Val Gln
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65 70 75 80

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Gly Ser Ser Ala Ile Ala Ser Asn Ile Lys His His Ala Glu Phe Ala
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ccc ttg ttc tct cca gat cac ttt tct ccc ctg aaa gct tac cat gcg 336
Pro Leu Phe Ser Pro Asp His Phe Ser Pro Leu Lys Ala Tyr His Ala

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105

110

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 Tyr Asp Tyr Tyr Asn Lys Met Asn Val Lys Gln Ala Tyr Tyr Leu Ser
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 Met Glu Phe Leu Gln Gly Arg Ala Leu Thr Asn Ala Ile Gly Asn Leu
 145 150 155 160

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 165 170 175

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 Leu Glu Asp Val Ala Ser Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly
 180 185 190

ggt tta ggc cgc ctg gct tct tgt ttt ttg gat tct ttg gca aca tta 624
 Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu
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 Asn Tyr Pro Ala Leu Gly Tyr Gly Leu Arg Tyr Glu Tyr Gly Leu Phe
 210 215 220

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 Lys Gln Ile Ile Thr Lys Asp Gly Gln Glu Glu Ile Ala Glu Asn Trp
 225 230 235 240

ctt gag atg gga tat cct tgg gag gtt gta aga aat gat gtc tct tat 768
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cac tgg att gga gga gaa aat atc aag gct gtg gca cat gat gtc cct 864
 His Trp Ile Gly Gly Glu Asn Ile Lys Ala Val Ala His Asp Val Pro
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aca act gta cca gca caa gat ttt gac ttg gca gct ttt aat tct gga 960
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gat cat acc aag gca tat gaa gct cat cta aac gct aaa aag ata tgc 1008
 Asp His Thr Lys Ala Tyr Glu Ala His Leu Asn Ala Lys Lys Ile Cys
 325 330 335

cac ata ttg tat cct ggg gat gaa tca cta gag ggg aaa gtt ctc cgc 1056
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 565 570 575

cct aag tta cca aga gtt gtc cga atg gca aac ctc tgt gtt gtt ggt 1776
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 755 760 765

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 770 775 780

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825

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Gln Arg Arg Val Ser Ala Arg Ser Val Ala Ser Asp Arg Asp Val Gln
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Gly Pro Val Ser Pro Ala Glu Gly Leu Pro Asn Val Leu Asn Ser Ile
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Gly Ser Ser Ala Ile Ala Ser Asn Ile Lys His His Ala Glu Phe Ala
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Pro Leu Phe Ser Pro Asp His Phe Ser Pro Leu Lys Ala Tyr His Ala
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Thr Ala Lys Ser Val Leu Asp Ala Leu Leu Ile Asn Trp Asn Ala Thr
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Tyr Asp Tyr Tyr Asn Lys Met Asn Val Lys Gln Ala Tyr Tyr Leu Ser
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Met Glu Phe Leu Gln Gly Arg Ala Leu Thr Asn Ala Ile Gly Asn Leu
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Glu Ile Thr Gly Glu Tyr Ala Glu Ala Leu Lys Gln Leu Gly Gln Asn
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Leu Glu Asp Val Ala Ser Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly
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195 200 205

Asn Tyr Pro Ala Leu Gly Tyr Gly Leu Arg Tyr Glu Tyr Gly Leu Phe
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Lys Gln Ile Ile Thr Lys Asp Gly Gln Glu Glu Ile Ala Glu Asn Trp
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Leu Glu Met Gly Tyr Pro Trp Glu Val Val Arg Asn Asp Val Ser Tyr
245 250 255

Pro Val Lys Phe Tyr Gly Lys Val Val Glu Gly Thr Asp Gly Arg Lys
260 265 270

His Trp Ile Gly Gly Glu Asn Ile Lys Ala Val Ala His Asp Val Pro
275 280 285

Ile Pro Gly Tyr Lys Thr Arg Thr Thr Asn Asn Leu Arg Leu Trp Ser
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Thr Thr Val Pro Ala Gln Asp Phe Asp Leu Ala Ala Phe Asn Ser Gly
305 310 315 320

Asp His Thr Lys Ala Tyr Glu Ala His Leu Asn Ala Lys Lys Ile Cys
325 330 335

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Leu Lys Gln Gln Tyr Thr Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile
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Ala Arg Phe Glu Ser Arg Ala Gly Glu Ser Leu Asn Trp Glu Asp Phe
370 375 380

Pro Ser Lys Val Ala Val Gln Met Asn Asp Thr His Pro Thr Leu Cys
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405 410 415

Ser Glu Ala Trp Ser Ile Thr Glu Arg Thr Val Ala Tyr Thr Asn His
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Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Leu Asp Ile Met Gln
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Pro Ala Ser Ile Ser Gln Leu Phe Val Lys Pro Lys Asp Lys Lys Glu
500 505 510

Ser Pro Ala Lys Ser Lys Gln Lys Leu Leu Val Lys Ser Leu Glu Thr
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Pro Lys Leu Pro Arg Val Val Arg Met Ala Asn Leu Cys Val Val Gly
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Gly His Ser Val Asn Gly Val Ala Glu Ile His Ser Glu Ile Val Lys
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Gln Asp Val Phe Asn Ser Phe Tyr Glu Met Trp Pro Thr Lys Phe Gln
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Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn
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Val Leu Asn Thr Asp Lys Leu Ala Glu Leu Lys Lys Phe Ala Asp Asn
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675 680 685

Lys Val Ile Ser Leu Ile Arg Glu Lys Thr Gly Tyr Ile Val Ser Pro
690 695 700

Asp Ala Met Phe Asp Val Gln Val Lys Arg Ile His Glu Tyr Lys Arg
705 710 715 720

Gln Leu Leu Asn Ile Leu Gly Ile Val Tyr Arg Tyr Lys Lys Met Lys
725 730 735

Glu Met Ser Thr Glu Glu Arg Ala Lys Ser Phe Val Pro Arg Val Cys
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Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Ile Gln Ala Lys Arg Ile
755 760 765

Val Lys Phe Ile Thr Asp Val Ala Ala Thr Val Asn His Asp Ser Asp
770 775 780

Ile Gly Asp Leu Leu Lys Val Val Phe Val Pro Asp Tyr Asn Val Ser
785 790 795 800

Val Ala Glu Ala Leu Ile Pro Ala Ser Glu Leu Ser Gln His Ile Ser
805 810 815

Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Met
820 825 830

Asn Gly Cys Ile Leu Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile
835 840 845

Arg Glu Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Glu Ala
850 855 860

His Glu Ile Ala Gly Leu Arg Lys Glu Arg Ala Glu Gly Lys Phe Val
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Pro Asp Pro Arg Phe Glu Glu Val Lys Glu Phe Val Arg Ser Gly Val
885 890 895

Phe Gly Thr Tyr Ser Tyr Asp Glu Leu Met Gly Ser Leu Glu Gly Asn
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Glu Gly Tyr Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro
915 920 925

Ser Tyr Ile Glu Cys Gln Glu Lys Val Asp Glu Ala Tyr Arg Asp Gln
930 935 940

Lys Leu Trp Thr Arg Met Ser Ile Leu Asn Thr Ala Gly Ser Ser Lys
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<222> (2)..(2788)

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gaa gag att tca agt gtg cta aat tcc atc gat tcc tct acc att gca 97
Glu Glu Ile Ser Ser Val Leu Asn Ser Ile Asp Ser Ser Thr Ile Ala
20 25 30

tca aac att aag cac cat gcg gag ttc aca cca gta ttc tct cca gag 145
Ser Asn Ile Lys His His Ala Glu Phe Thr Pro Val Phe Ser Pro Glu
35 40 45

cac ttt tca cct ctg aag gct tac cat gca act gct aaa agt gtt ctt 193
His Phe Ser Pro Leu Lys Ala Tyr His Ala Thr Ala Lys Ser Val Leu
50 55 60

gat act ctg ata atg aac tgg aat gca aca tat gac tat tac gac aga 241
Asp Thr Leu Ile Met Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr Asp Arg
65 70 75 80

aca aat gtg aag caa gcg tat tac ctg tcc atg gag ttt tta cag gga 289
Thr Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly
85 90 95

aga gct ctc act aat gcc gtt ggt aac ctt gag cta act gga caa tac 337
Arg Ala Leu Thr Asn Ala Val Gly Asn Leu Glu Leu Thr Gly Gln Tyr
100 105 110

gca gaa gca cta caa ctt gga cac agc cta gag gat gtt gct acc 385
Ala Glu Ala Leu Gln Gln Leu Gly His Ser Leu Glu Asp Val Ala Thr
115 120 125

cag gag cca gat gct gcc ctt ggg aat ggt ggt cta ggc cgg tta gct 433
Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala
130 135 140

tcc tgt ttc ttg gat tct ctg gca acc cta aat tat cca gca tgg gga 481
Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala Trp Gly
145 150 155 160

tat gga ctt cga tac aaa cat ggc ctc ttt aag caa atc ata acg aag 529
Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys Gln Ile Ile Thr Lys
165 170 175

gat ggt cag gag gag gta gct gaa aat tgg ctc gag atg gga aat cct 577
Asp Gly Gln Glu Glu Val Ala Glu Asn Trp Leu Glu Met Gly Asn Pro
180 185 190

tgg gag att gta aga acc gat gtc tcc tat cct gtg aag ttc tat ggt 625
Trp Glu Ile Val Arg Thr Asp Val Ser Tyr Pro Val Lys Phe Tyr Gly
195 200 205

aaa gtg gtt gaa ggc act gat ggg agg atg cac tgg att gga gga gaa 673
Lys Val Val Glu Gly Thr Asp Gly Arg Met His Trp Ile Gly Gly Glu
210 215 220

aat atc aag gtt gtt gct cat gat atc cct att cct ggc tac aag act 721
Asn Ile Lys Val Val Ala His Asp Ile Pro Ile Pro Gly Tyr Lys Thr
225 230 235 240

aaa act acc aac aat ctt cgt ctt tgg tca aca aca gtg cca tca caa 769
Lys Thr Thr Asn Asn Leu Arg Leu Trp Ser Thr Thr Val Pro Ser Gln
245 250 255

gat ttc gat ttg gaa gct ttt aat gct gga gat cat gca agt gca tat 817
Asp Phe Asp Leu Glu Ala Phe Asn Ala Gly Asp His Ala Ser Ala Tyr
260 265 270

gaa gct cat cta aat gct gaa aag ata tgt cac gta ctg tat cct ggg 865
Glu Ala His Leu Asn Ala Glu Lys Ile Cys His Val Leu Tyr Pro Gly
275 280 285

gac gaa tca cca gag ggg aaa gtt ctt cgc ctg aag caa caa tat aca 913
Asp Glu Ser Pro Glu Gly Lys Val Leu Arg Leu Lys Gln Gln Tyr Thr
290 295 300

tta tgc tca gcc tca cta cag gat att att gct cgt ttc gag agg aga 961
Leu Cys Ser Ala Ser Leu Glu Asp Ile Ile Ala Arg Phe Glu Arg Arg
305 310 315 320

gct ggt gat tct ctc agc tgg gag gac ttc ccc tct aaa gtt gca gtg 1009
Ala Gly Asp Ser Leu Ser Trp Glu Asp Phe Pro Ser Lys Val Ala Val
325 330 335

cag atg aat gac act cac cca aca ctg tgc att cct gag ttg atg aga 1057
Gln Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu Met Arg
340 345 350

ata ttg att gat gtt aaa ggg tta agc tgg aat gag gct tgg agt atc 1105
Ile Leu Ile Asp Val Lys Gly Leu Ser Trp Asn Glu Ala Trp Ser Ile
355 360 365

aca gaa aga act gtg gca tac aca aac cac acg gtg ctt cct gaa gct 1153
Thr Glu Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala
370 375 380

ctg gag aag tgg agc ttg gac ata atg cag aaa ctt ctt cct cgg cat 1201
Leu Glu Lys Trp Ser Leu Asp Ile Met Gln Lys Leu Leu Pro Arg His
385 390 395 400

gtt gaa atc ata gaa aaa att gat ggg gag ctg atg aac atc att atc 1249
Val Glu Ile Ile Glu Lys Ile Asp Gly Glu Leu Met Asn Ile Ile Ile
405 410 415

tca aaa tac gga aca gaa gat act tca ctg tta aaa aag aag att aaa 1297
Ser Lys Tyr Gly Thr Glu Asp Thr Ser Leu Leu Lys Lys Lys Ile Lys
420 425 430

gaa atg aga atc tta gac aac att gac cta cca gat tct att gcc aaa 1345
Glu Met Arg Ile Leu Asp Asn Ile Asp Leu Pro Asp Ser Ile Ala Lys
435 440 445

cta ttt gtg aaa cca aaa gag aaa aaa gaa tct cct gct aaa ttg aaa 1393
 Leu Phe Val Lys Pro Lys Glu Lys Lys Glu Ser Pro Ala Lys Leu Lys
 450 455 460

gag aaa ttg ctt gtc aaa tct ctg gag cct agt gtt gtg gtt gag gag 1441
 Glu Lys Leu Leu Val Lys Ser Leu Glu Pro Ser Val Val Glu Glu
 465 470 475 480

aaa act gtg tcc aaa gta gag ata aac gag gac tct gag gag gtg gag 1489
 Lys Thr Val Ser Lys Val Glu Ile Asn Glu Asp Ser Glu Glu Val Glu
 485 490 495

gta gac tct gaa gaa gtt gtg gag gca gaa aac gag gac tct gag gat 1537
 Val Asp Ser Glu Glu Val Val Glu Ala Glu Asn Glu Asp Ser Glu Asp
 500 505 510

gag tta gat cca ttt gta aaa tca gat cct aaa tta cct aga gtt gtc 1585
 Glu Leu Asp Pro Phe Val Lys Ser Asp Pro Lys Leu Pro Arg Val Val
 515 520 525

cga atg gct aac ctt tgt gtt ggt ggg cat tcg gtt aat ggt gtg 1633
 Arg Met Ala Asn Leu Cys Val Val Gly Gly His Ser Val Asn Gly Val
 530 535 540

gct gcg att cac agc gag att gtg aaa gaa gat gta ttc aac agc ttt 1681
 Ala Ala Ile His Ser Glu Ile Val Lys Glu Asp Val Phe Asn Ser Phe
 545 550 555 560

tat gag atg tgg ccc gct aaa ttt caa aat aaa aca aat gga gtg act 1729
 Tyr Glu Met Trp Pro Ala Lys Phe Gln Asn Lys Thr Asn Gly Val Thr
 565 570 575

cct aga cgt tgg att cgg ttt tgt aat cct gaa tta agt gca atc att 1777
 Pro Arg Arg Trp Ile Arg Phe Cys Asn Pro Glu Leu Ser Ala Ile Ile
 580 585 590

tca aaa tgg ata gga tct gat gat tgg gtt ttg aac act gat aaa ctt 1825
 Ser Lys Trp Ile Gly Ser Asp Asp Trp Val Leu Asn Thr Asp Lys Leu
 595 600 605

gct gaa tta aag aag ttt gct gat gat gag gat ctg caa tca gaa tgg 1873
 Ala Glu Leu Lys Lys Phe Ala Asp Asp Glu Asp Leu Gln Ser Glu Trp
 610 615 620

cgt gct gct aaa aag gct aac aag gtg aag gtt gtt tct ctc ata aga 1921
 Arg Ala Ala Lys Lys Ala Asn Lys Val Lys Val Val Ser Leu Ile Arg
 625 630 635 640

gaa aaa aca gga tat atc gtc agt cca gat gca atg ttt gac gtt cag 1969
 Glu Lys Thr Gly Tyr Ile Val Ser Pro Asp Ala Met Phe Asp Val Gln
 645 650 655

gtg aaa agg atc cat gag tat aag cga cag ctg cta aat atc ctt gga 2017
 Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly
 660 665 670

att gtc tac cgc tac aag aag atg aaa gaa atg agt gca aaa gac aga 2065
 Ile Val Tyr Arg Tyr Lys Lys Met Lys Glu Met Ser Ala Lys Asp Arg
 675 680 685

ata aat agc ttt gtt cca agg gta tgc ata ttt ggt ggg aaa gca ttt 2113
Ile Asn Ser Phe Val Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe
690 695 700

gcc act tac gta cag gca aag agg ata gtg aag ttt att aca gat gtt 2161
Ala Thr Tyr Val Gln Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val
705 710 715 720

gca gct act gta aat cat gat cca gaa att gga gat cta ttg aag gtt 2209
Ala Ala Thr Val Asn His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val
725 730 735

gta ttt att cca gat tat aat gtt agt gtt gct gag gcg cta atc cct 2257
Val Phe Ile Pro Asp Tyr Asn Val Ser Val Ala Glu Ala Leu Ile Pro
740 745 750

gcc agt gaa ttg tct cag cat atc agt act gct gga atg gaa gct agt 2305
Ala Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser
755 760 765

gga acc agc aac atg aag ttt gca atg aat gga ttt atc ctt att gga 2353
Gly Thr Ser Asn Met Lys Phe Ala Met Asn Gly Cys Ile Leu Ile Gly
770 775 780

act ttg gat ggt gct aat gtt gaa atc aga gag gag gtt gga gag gaa 2401
Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Val Gly Glu Glu
785 790 795 800

aac ttt ttc ctt ttt ggt gct gag gca cat gaa att gct ggt tta agg 2449
Asn Phe Leu Phe Gly Ala Glu Ala His Glu Ile Ala Gly Leu Arg
805 810 815

aaa gag aga gcc cag gga aag ttt gtt cct gac cca aga ttc gaa gag 2497
Lys Glu Arg Ala Gln Gly Lys Phe Val Pro Asp Pro Arg Phe Glu Glu
820 825 830

gtt aag aga ttt gtc cgc agt ggg gtc ttt gga act tac aac tac gat 2545
Val Lys Arg Phe Val Arg Ser Gly Val Phe Gly Thr Tyr Asn Tyr Asp
835 840 845

gac ttg atg ggt tct ctg gaa gga aat gaa ggt tat ggg cgt gca gac 2593
Asp Leu Met Gly Ser Leu Glu Gly Asn Glu Gly Tyr Arg Ala Asp
850 855 860

tat ttt ctt gtt ggt aaa gat ttc ccc agc tac att gaa tgc cag gag 2641
Tyr Phe Leu Val Gly Lys Asp Phe Pro Ser Tyr Ile Glu Cys Gln Glu
865 870 875 880

aag gtt gat aaa gca tac cgc gat cag aaa cta tgg aca agg atg tca 2689
Lys Val Asp Lys Ala Tyr Arg Asp Gln Lys Leu Trp Thr Arg Met Ser
885 890 895

atc ctc aac aca gcc agt tcc tcc aag ttc aac agc gac cgg acg att 2737
Ile Leu Asn Thr Ala Ser Ser Ser Lys Phe Asn Ser Asp Arg Thr Ile
900 905 910

cac gag tac gcc aag gac atc tgg gac atc aag cct gtc atc ctg ccc 2785
His Glu Tyr Ala Lys Asp Ile Trp Asp Ile Lys Pro Val Ile Leu Pro
915 920 925

tag acaggcaagg caagcactag ccactccctg ccagcgacct tcagagctaa 2838
ggtcgcgcga accgggtatcg cgtacacgc atctgcctcc cagctctcct tggcaggaag 2898
gttcgcctt gctccagtt ttgagtagac agaagcaagt tcagttcagg ctgcataaa 2958
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<213> Oryza sativa

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20 25 30

Ser Asn Ile Lys His His Ala Glu Phe Thr Pro Val Phe Ser Pro Glu
35 40 45

His Phe Ser Pro Leu Lys Ala Tyr His Ala Thr Ala Lys Ser Val Leu
50 55 60

Asp Thr Leu Ile Met Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr Asp Arg
65 70 75 80

Thr Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly
85 90 95

Arg Ala Leu Thr Asn Ala Val Gly Asn Leu Glu Leu Thr Gly Gln Tyr
100 105 110

Ala Glu Ala Leu Gln Gln Leu Gly His Ser Leu Glu Asp Val Ala Thr
115 120 125

Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala
130 135 140

Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala Trp Gly

145 150 155 160

Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys Gln Ile Ile Thr Lys
165 170 175

Asp Gly Gln Glu Glu Val Ala Glu Asn Trp Leu Glu Met Gly Asn Pro
180 185 190

Trp Glu Ile Val Arg Thr Asp Val Ser Tyr Pro Val Lys Phe Tyr Gly
195 200 205

Lys Val Val Glu Gly Thr Asp Gly Arg Met His Trp Ile Gly Gly Glu
210 215 220

Asn Ile Lys Val Val Ala His Asp Ile Pro Ile Pro Gly Tyr Lys Thr
225 230 235 240

Lys Thr Thr Asn Asn Leu Arg Leu Trp Ser Thr Thr Val Pro Ser Gln
245 250 255

Asp Phe Asp Leu Glu Ala Phe Asn Ala Gly Asp His Ala Ser Ala Tyr
260 265 270

Glu Ala His Leu Asn Ala Glu Lys Ile Cys His Val Leu Tyr Pro Gly
275 280 285

Asp Glu Ser Pro Glu Gly Lys Val Leu Arg Leu Lys Gln Gln Tyr Thr
290 295 300

Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe Glu Arg Arg
305 310 315 320

Ala Gly Asp Ser Leu Ser Trp Glu Asp Phe Pro Ser Lys Val Ala Val
325 330 335

Gln Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu Met Arg
340 345 350

Ile Leu Ile Asp Val Lys Gly Leu Ser Trp Asn Glu Ala Trp Ser Ile
355 360 365

Thr Glu Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala
370 375 380

Leu Glu Lys Trp Ser Leu Asp Ile Met Gln Lys Leu Leu Pro Arg His

385 390 395 400

Val Glu Ile Ile Glu Lys Ile Asp Gly Glu Leu Met Asn Ile Ile Ile
405 410 415

Ser Lys Tyr Gly Thr Glu Asp Thr Ser Leu Leu Lys Lys Lys Ile Lys
420 425 430

Glu Met Arg Ile Leu Asp Asn Ile Asp Leu Pro Asp Ser Ile Ala Lys
435 440 445

Leu Phe Val Lys Pro Lys Glu Lys Lys Glu Ser Pro Ala Lys Leu Lys
450 455 460

Glu Lys Leu Leu Val Lys Ser Leu Glu Pro Ser Val Val Val Glu Glu
465 470 475 480

Lys Thr Val Ser Lys Val Glu Ile Asn Glu Asp Ser Glu Glu Val Glu
485 490 495

Val Asp Ser Glu Glu Val Val Glu Ala Asn Glu Asp Ser Glu Asp
500 505 510

Glu Leu Asp Pro Phe Val Lys Ser Asp Pro Lys Leu Pro Arg Val Val
515 520 525

Arg Met Ala Asn Leu Cys Val Val Gly Gly His Ser Val Asn Gly Val
530 535 540

Ala Ala Ile His Ser Glu Ile Val Lys Glu Asp Val Phe Asn Ser Phe
545 550 555 560

Tyr Glu Met Trp Pro Ala Lys Phe Gln Asn Lys Thr Asn Gly Val Thr
565 570 575

Pro Arg Arg Trp Ile Arg Phe Cys Asn Pro Glu Leu Ser Ala Ile Ile
580 585 590

Ser Lys Trp Ile Gly Ser Asp Asp Trp Val Leu Asn Thr Asp Lys Leu
595 600 605

Ala Glu Leu Lys Lys Phe Ala Asp Asp Glu Asp Leu Gln Ser Glu Trp
610 615 620

Arg Ala Ala Lys Lys Ala Asn Lys Val Lys Val Val Ser Leu Ile Arg

625 630 635 640

Glu Lys Thr Gly Tyr Ile Val Ser Pro Asp Ala Met Phe Asp Val Gln
645 650 655

Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly
660 665 670

Ile Val Tyr Arg Tyr Lys Lys Met Lys Glu Met Ser Ala Lys Asp Arg
675 680 685

Ile Asn Ser Phe Val Pro Arg Val Cys Ile Phe Gly Gly Lys Ala Phe
690 695 700

Ala Thr Tyr Val Gln Ala Lys Arg Ile Val Lys Phe Ile Thr Asp Val
705 710 715 720

Ala Ala Thr Val Asn His Asp Pro Glu Ile Gly Asp Leu Leu Lys Val
725 730 735

Val Phe Ile Pro Asp Tyr Asn Val Ser Val Ala Glu Ala Leu Ile Pro
740 745 750

Ala Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser
755 760 765

Gly Thr Ser Asn Met Lys Phe Ala Met Asn Gly Cys Ile Leu Ile Gly
770 775 780

Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Val Gly Glu Glu
785 790 795 800

Asn Phe Phe Leu Phe Gly Ala Glu Ala His Glu Ile Ala Gly Leu Arg
805 810 815

Lys Glu Arg Ala Gln Gly Lys Phe Val Pro Asp Pro Arg Phe Glu Glu
820 825 830

Val Lys Arg Phe Val Arg Ser Gly Val Phe Gly Thr Tyr Asn Tyr Asp
835 840 845

Asp Leu Met Gly Ser Leu Glu Gly Asn Glu Gly Tyr Gly Arg Ala Asp
850 855 860

Tyr Phe Leu Val Gly Lys Asp Phe Pro Ser Tyr Ile Glu Cys Gln Glu

865 870 875 880

Lys Val Asp Lys Ala Tyr Arg Asp Gln Lys Leu Trp Thr Arg Met Ser
885 890 895

Ile Leu Asn Thr Ala Ser Ser Ser Lys Phe Asn Ser Asp Arg Thr Ile
900 905 910

His Glu Tyr Ala Lys Asp Ile Trp Asp Ile Lys Pro Val Ile Leu Pro
915 920 925

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Leu Pro Val Gly Val Gly Cys Gly Gly Gly Gly Gly Leu His
20 25 30

gtg ggt ggt gcc cgc ggc ggg ggc gcg gca ccg gcg cgg cgg ctg 144
Val Gly Gly Ala Arg Gly Gly Ala Ala Pro Ala Arg Arg Arg Leu
35 40 45

gcg gtg cgg agc gtg gcg agc gat cgg ggc gtg cag ggg tcg gtg tcg 192
Ala Val Arg Ser Val Ala Ser Asp Arg Gly Val Gln Gly Ser Val Ser
50 55 60

ccc gag gaa gag att tca agt gtg cta aat tcc atc gat tcc tct acc 240
Pro Glu Glu Glu Ile Ser Ser Val Leu Asn Ser Ile Asp Ser Ser Thr
65 70 75 80

att gca tca aac att aag cac cat gcg gag ttc aca cca gta ttc tct 288
Ile Ala Ser Asn Ile Lys His His Ala Glu Phe Thr Pro Val Phe Ser
85 90 95

cca gag cac ttt tca cct ctg aag gct tac cat gca act gct aaa agt 336
Pro Glu His Phe Ser Pro Leu Lys Ala Tyr His Ala Thr Ala Lys Ser
100 105 110

gtt ctt gat act ctg ata atg aac tgg aat gca aca tat gac tat tac 384
Val Leu Asp Thr Leu Ile Met Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr
115 120 125

gac aga aca aat gtg aag caa gcg tat tac ctg tcc atg gag ttt tta 432
Asp Arg Thr Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu

130 135 140

cag gga aga gct ctc act aat gcc gtt ggt aac ctt gag cta act gga 480
Gln Gly Arg Ala Leu Thr Asn Ala Val Gly Asn Leu Glu Leu Thr Gly
145 150 155 160

caa tac gca gaa gca cta caa ctt gga cac agc cta gag gat gtt 528
Gln Tyr Ala Glu Ala Leu Gln Gln Leu Gly His Ser Leu Glu Asp Val
165 170 175

gct acc cag gag cca gat gct gcc ctt ggg aat ggt ggt cta ggc cgg 576
Ala Thr Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg
180 185 190

tta gct tcc tgt ttc ttg gat tct ctg gca acc cta aat tat cca gca 624
Leu Ala Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala
195 200 205

tgg gga tat gga ctt cga tac aaa cat ggc ctc ttt aaa gca aat cat 672
Trp Gly Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys Ala Asn His
210 215 220

acg aag gat ggt cag gag gag gta gct gaa aat tgg ctc gag atg gga 720
Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asn Trp Leu Glu Met Gly
225 230 235 240

aat cct tgg gag att gta aga acc gat gtc tcc tat cct gtg aag ttc 768
Asn Pro Trp Glu Ile Val Arg Thr Asp Val Ser Tyr Pro Val Lys Phe
245 250 255

tat ggt aaa gtg gtt gaa ggc act gat ggg agg atg cac tgg att gga 816
Tyr Gly Lys Val Val Glu Gly Thr Asp Gly Arg Met His Trp Ile Gly
260 265 270

gga gaa aat atc aag gtt gct cat gat atc cct att cct ggc tac 864
Gly Glu Asn Ile Lys Val Val Ala His Asp Ile Pro Ile Pro Gly Tyr
275 280 285

aag act aaa act acc aac aat ctt cgt ctt tgg tca aca aca gtg cca 912
Lys Thr Lys Thr Asn Asn Leu Arg Leu Trp Ser Thr Thr Val Pro
290 295 300

tca caa gat ttc gat ttg gaa gct ttt aat gct gga gat cat gca agt 960
Ser Gln Asp Phe Asp Leu Glu Ala Phe Asn Ala Gly Asp His Ala Ser
305 310 315 320

gca tat gaa gct cat cta aat gct gaa aag cct cac tac agg gat att 1008
Ala Tyr Glu Ala His Leu Asn Ala Glu Lys Pro His Tyr Arg Asp Ile
325 330 335

att gct cgt ttc gag agg aga gct ggt gat tct ctc agc tgg gag gac 1056
Ile Ala Arg Phe Glu Arg Arg Ala Gly Asp Ser Leu Ser Trp Glu Asp
340 345 350

ttc ccc tct aaa gtt gca gtg cag atg aat gac act cac cca aca ctg 1104
Phe Pro Ser Lys Val Ala Val Gln Met Asn Asp Thr His Pro Thr Leu
355 360 365

tgc att cct gag ttg atg aga ata ttg att gat gtt aaa ggg tta agc 1152
Cys Ile Pro Glu Leu Met Arg Ile Leu Ile Asp Val Lys Gly Leu Ser

370 375 380

tgg aat gag gct tgg agt atc aca gaa aga act gtg gca tac aca aac 1200
Trp Asn Glu Ala Trp Ser Ile Thr Glu Arg Thr Val Ala Tyr Thr Asn
385 390 395 400

cac acg gtg ctt cct gaa gct ctg gag aag tgg agc ttg gac ata atg 1248
His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Leu Asp Ile Met
405 410 415

cag aaa ctt ctt cct cgg cat gtt gaa atc ata gaa aaa att gat ggg 1296
Gln Lys Leu Leu Pro Arg His Val Glu Ile Ile Glu Lys Ile Asp Gly
420 425 430

gag ctg atg aac atc att atc tca aaa tac gga aca gaa gat act tca 1344
Glu Leu Met Asn Ile Ile Ser Lys Tyr Gly Thr Glu Asp Thr Ser
435 440 445

ctg tta aaa aag aag att aaa gaa atg aga atc tta gac aac att gac 1392
Leu Leu Lys Lys Ile Lys Glu Met Arg Ile Leu Asp Asn Ile Asp
450 455 460

cta cca gat tct att gcc aaa cta ttt gtg aaa cca aaa gag aaa aaa 1440
Leu Pro Asp Ser Ile Ala Lys Leu Phe Val Lys Pro Lys Glu Lys Lys
465 470 475 480

gaa tct cct gct aaa ttg aaa gag aaa ttg ctt gtc aaa tct ctg gag 1488
Glu Ser Pro Ala Lys Leu Lys Glu Lys Leu Leu Val Lys Ser Leu Glu
485 490 495

cct agt gtt gtg gtt gag gag aaa act gtg tcc aaa gta gag ata aac 1536
Pro Ser Val Val Val Glu Glu Lys Thr Val Ser Lys Val Glu Ile Asn
500 505 510

gag gac tct gag gag gtg gag gta gac tct gaa gaa gtt gtg gag gca 1584
Glu Asp Ser Glu Glu Val Glu Val Asp Ser Glu Glu Val Val Glu Ala
515 520 525

gaa aac gag gac tct gag gag tta gat cca ttt gta aaa tca gat 1632
Glu Asn Glu Asp Ser Glu Asp Glu Leu Asp Pro Phe Val Lys Ser Asp
530 535 540

cct aaa tta cct aga gtt gtc cga atg gct aac ctt tgt gtt ggt 1680
Pro Lys Leu Pro Arg Val Val Arg Met Ala Asn Leu Cys Val Val Gly
545 550 555 560

ggg cat tcg gtt aat ggt gtg gct gcg att cac agc gag att gtg aaa 1728
Gly His Ser Val Asn Gly Val Ala Ala Ile His Ser Glu Ile Val Lys
565 570 575

gaa gat gta ttc aac agc ttt tat gag atg tgg ccc gct aaa ttt caa 1776
Glu Asp Val Phe Asn Ser Phe Tyr Glu Met Trp Pro Ala Lys Phe Gln
580 585 590

aat aaa aca aat gga gtg act cct aga cgt tgg att cgg ttt tgt aat 1824
Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn
595 600 605

cct gaa tta agt gca atc att tca aaa tgg ata gga tct gat gat tgg 1872
Pro Glu Leu Ser Ala Ile Ile Ser Lys Trp Ile Gly Ser Asp Asp Trp

610

615

620

gtt ttg aac act gat aaa ctt gct gaa tta aag aag ttt gct gat gat 1920
 Val Leu Asn Thr Asp Lys Leu Ala Glu Leu Lys Lys Phe Ala Asp Asp
 625 630 635 640

gag gat ctg caa tca gaa tgg cgt gct gct aaa aag gct aac aag gtg 1968
 Glu Asp Leu Gln Ser Glu Trp Arg Ala Ala Lys Lys Ala Asn Lys Val
 645 650 655

aag gtt gtt tct ctc ata aga gaa aaa aca gga tat atc gtc agt cca 2016
 Lys Val Val Ser Leu Ile Arg Glu Lys Thr Gly Tyr Ile Val Ser Pro
 660 665 670

gat gca atg ttt gac gtt cag gtg aaa agg atc cat gag tat aag cga 2064
 Asp Ala Met Phe Asp Val Gln Val Lys Arg Ile His Glu Tyr Lys Arg
 675 680 685

cag ctg cta aat atc ctt gga att gtc tac cgc tac aag aag atg aaa 2112
 Gln Leu Leu Asn Ile Leu Gly Ile Val Tyr Arg Tyr Lys Lys Met Lys
 690 695 700

gaa atg agt gca aaa gac aga ata aat agc ttt gtt cca agg gta tgc 2160
 Glu Met Ser Ala Lys Asp Arg Ile Asn Ser Phe Val Pro Arg Val Cys
 705 710 715 720

ata ttt ggt ggg aaa gca ttt gcc act tac gta cag gca aag agg ata 2208
 Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln Ala Lys Arg Ile
 725 730 735

gtg aag ttt att aca gat gtt gca gct act gta aat cat gat cca gaa 2256
 Val Lys Phe Ile Thr Asp Val Ala Ala Thr Val Asn His Asp Pro Glu
 740 745 750

att gga gat cta ttg aag gtt gta ttt att cca gat tat aat gtt agt 2304
 Ile Gly Asp Leu Leu Lys Val Val Phe Ile Pro Asp Tyr Asn Val Ser
 755 760 765

gtt gct gag gcg cta atc cct gcc agt gaa ttg tct cag cat atc agt 2352
 Val Ala Glu Ala Leu Ile Pro Ala Ser Glu Leu Ser Gln His Ile Ser
 770 775 780

act gct gga atg gaa gct agt gga acc aac atg aag ttt gca atg 2400
 Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Met
 785 790 795 800

aat gga tgt atc ctt att gga act ttg gat ggt gct aat gtg gaa atc 2448
 Asn Gly Cys Ile Leu Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile
 805 810 815

aga gag gag gtt gga gag gaa aac ttt ttc ctt ttt ggt gct gag gca 2496
 Arg Glu Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Glu Ala
 820 825 830

cat gaa att gct ggt tta agg aaa gag aga gcc cag gga aag ttt gtg 2544
 His Glu Ile Ala Gly Leu Arg Lys Glu Arg Ala Gln Gly Lys Phe Val
 835 840 845

cct gac cca aga ttc gaa gag gtt aag aga ttt gtc cgc agt ggg gtc 2592
 Pro Asp Pro Arg Phe Glu Glu Val Lys Arg Phe Val Arg Ser Gly Val

850 855 860

ttt gga act tac aac tac gat gac ttg atg ggt tct ctg gaa gga aat 2640
Phe Gly Thr Tyr Asn Tyr Asp Asp Leu Met Gly Ser Leu Glu Gly Asn
865 870 875 880

gaa ggt tat ggg cgt gca gac tat ttt ctt gtt ggt aaa gat ttc ccc 2688
Glu Gly Tyr Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro
885 890 895

agc tac att gaa tgc cag gag aag gtt gat aaa gca tac cgc gat cag 2736
Ser Tyr Ile Glu Cys Gln Glu Lys Val Asp Lys Ala Tyr Arg Asp Gln
900 905 910

aaa cta tgg aca agg atg tca atc ctc aac aca gcc agt tcc tcc aag 2784
Lys Leu Trp Thr Arg Met Ser Ile Leu Asn Thr Ala Ser Ser Ser Lys
915 920 925

ttc aac agc gac cgg acg att cac gag tac gcc aag gac atc tgg gac 2832
Phe Asn Ser Asp Arg Thr Ile His Glu Tyr Ala Lys Asp Ile Trp Asp
930 935 940

atc aag cct gtc atc ctg ccc tag 2856
Ile Lys Pro Val Ile Leu Pro
945 950

<210> 18
<211> 951
<212> PRT
<213> Oryza sativa

<400> 18

Met Ala Thr Ala Ser Ala Pro Leu Gln Leu Ala Thr Ala Ser Arg Pro
1 5 10 15

Leu Pro Val Gly Val Gly Cys Gly Gly Gly Gly Gly Gly Leu His
20 25 30

Val Gly Gly Ala Arg Gly Gly Gly Ala Ala Pro Ala Arg Arg Arg Leu
35 40 45

Ala Val Arg Ser Val Ala Ser Asp Arg Gly Val Gln Gly Ser Val Ser
50 55 60

Pro Glu Glu Glu Ile Ser Ser Val Leu Asn Ser Ile Asp Ser Ser Thr
65 70 75 80

Ile Ala Ser Asn Ile Lys His His Ala Glu Phe Thr Pro Val Phe Ser
85 90 95

Pro Glu His Phe Ser Pro Leu Lys Ala Tyr His Ala Thr Ala Lys Ser
100 105 110

Val Leu Asp Thr Leu Ile Met Asn Trp Asn Ala Thr Tyr Asp Tyr Tyr
115 120 125

Asp Arg Thr Asn Val Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu
130 135 140

Gln Gly Arg Ala Leu Thr Asn Ala Val Gly Asn Leu Glu Leu Thr Gly
145 150 155 160

Gln Tyr Ala Glu Ala Leu Gln Gln Leu Gly His Ser Leu Glu Asp Val
165 170 175

Ala Thr Gln Glu Pro Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg
180 185 190

Leu Ala Ser Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala
195 200 205

Trp Gly Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys Ala Asn His
210 215 220

Thr Lys Asp Gly Gln Glu Glu Val Ala Glu Asn Trp Leu Glu Met Gly
225 230 235 240

Asn Pro Trp Glu Ile Val Arg Thr Asp Val Ser Tyr Pro Val Lys Phe
245 250 255

Tyr Gly Lys Val Val Glu Gly Thr Asp Gly Arg Met His Trp Ile Gly
260 265 270

Gly Glu Asn Ile Lys Val Val Ala His Asp Ile Pro Ile Pro Gly Tyr
275 280 285

Lys Thr Lys Thr Thr Asn Asn Leu Arg Leu Trp Ser Thr Thr Val Pro
290 295 300

Ser Gln Asp Phe Asp Leu Glu Ala Phe Asn Ala Gly Asp His Ala Ser
305 310 315 320

Ala Tyr Glu Ala His Leu Asn Ala Glu Lys Pro His Tyr Arg Asp Ile
325 330 335

Ile Ala Arg Phe Glu Arg Arg Ala Gly Asp Ser Leu Ser Trp Glu Asp
340 345 350

Phe Pro Ser Lys Val Ala Val Gln Met Asn Asp Thr His Pro Thr Leu
355 360 365

Cys Ile Pro Glu Leu Met Arg Ile Leu Ile Asp Val Lys Gly Leu Ser
370 375 380

Trp Asn Glu Ala Trp Ser Ile Thr Glu Arg Thr Val Ala Tyr Thr Asn
385 390 395 400

His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Leu Asp Ile Met
405 410 415

Gln Lys Leu Leu Pro Arg His Val Glu Ile Ile Glu Lys Ile Asp Gly
420 425 430

Glu Leu Met Asn Ile Ile Ile Ser Lys Tyr Gly Thr Glu Asp Thr Ser
435 440 445

Leu Leu Lys Lys Ile Lys Glu Met Arg Ile Leu Asp Asn Ile Asp
450 455 460

Leu Pro Asp Ser Ile Ala Lys Leu Phe Val Lys Pro Lys Glu Lys Lys
465 470 475 480

Glu Ser Pro Ala Lys Leu Lys Glu Lys Leu Leu Val Lys Ser Leu Glu
485 490 495

Pro Ser Val Val Val Glu Glu Lys Thr Val Ser Lys Val Glu Ile Asn
500 505 510

Glu Asp Ser Glu Glu Val Glu Val Asp Ser Glu Glu Val Val Glu Ala
515 520 525

Glu Asn Glu Asp Ser Glu Asp Glu Leu Asp Pro Phe Val Lys Ser Asp
530 535 540

Pro Lys Leu Pro Arg Val Val Arg Met Ala Asn Leu Cys Val Val Gly
545 550 555 560

Gly His Ser Val Asn Gly Val Ala Ala Ile His Ser Glu Ile Val Lys
565 570 575

Glu Asp Val Phe Asn Ser Phe Tyr Glu Met Trp Pro Ala Lys Phe Gln
580 585 590

Asn Lys Thr Asn Gly Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn
595 600 605

Pro Glu Leu Ser Ala Ile Ile Ser Lys Trp Ile Gly Ser Asp Asp Trp
610 615 620

Val Leu Asn Thr Asp Lys Leu Ala Glu Leu Lys Lys Phe Ala Asp Asp
625 630 635 640

Glu Asp Leu Gln Ser Glu Trp Arg Ala Ala Lys Lys Ala Asn Lys Val
645 650 655

Lys Val Val Ser Leu Ile Arg Glu Lys Thr Gly Tyr Ile Val Ser Pro
660 665 670

Asp Ala Met Phe Asp Val Gln Val Lys Arg Ile His Glu Tyr Lys Arg
675 680 685

Gln Leu Leu Asn Ile Leu Gly Ile Val Tyr Arg Tyr Lys Lys Met Lys
690 695 700

Glu Met Ser Ala Lys Asp Arg Ile Asn Ser Phe Val Pro Arg Val Cys
705 710 715 720

Ile Phe Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln Ala Lys Arg Ile
725 730 735

Val Lys Phe Ile Thr Asp Val Ala Ala Thr Val Asn His Asp Pro Glu
740 745 750

Ile Gly Asp Leu Leu Lys Val Val Phe Ile Pro Asp Tyr Asn Val Ser
755 760 765

Val Ala Glu Ala Leu Ile Pro Ala Ser Glu Leu Ser Gln His Ile Ser
770 775 780

Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Met
785 790 795 800

Asn Gly Cys Ile Leu Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile
805 810 815

Arg Glu Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Glu Ala
820 825 830

His Glu Ile Ala Gly Leu Arg Lys Glu Arg Ala Gln Gly Lys Phe Val
835 840 845

Pro Asp Pro Arg Phe Glu Glu Val Lys Arg Phe Val Arg Ser Gly Val
850 855 860

Phe Gly Thr Tyr Asn Tyr Asp Asp Leu Met Gly Ser Leu Glu Gly Asn
865 870 875 880

Glu Gly Tyr Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro
885 890 895

Ser Tyr Ile Glu Cys Gln Glu Lys Val Asp Lys Ala Tyr Arg Asp Gln
900 905 910

Lys Leu Trp Thr Arg Met Ser Ile Leu Asn Thr Ala Ser Ser Ser Lys
915 920 925

Phe Asn Ser Asp Arg Thr Ile His Glu Tyr Ala Lys Asp Ile Trp Asp
930 935 940

Ile Lys Pro Val Ile Leu Pro
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<212> DNA
<213> Triticum aestivum

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<222> (58)..(2556)

<400> 19
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Met Ser Ala Ala Asp Lys Val Lys Pro Ala Ala Ser Pro Ala Ser Glu
1 5 10 15

gac ccc tcc gcc atc gcc ggc aac atc tcc tac cac gct cag tac agc 153
Asp Pro Ser Ala Ile Ala Gly Asn Ile Ser Tyr His Ala Gln Tyr Ser
20 25 30

ccc cac ttc tcg ctc gcc ttc ggc ccc gag cag gcc ttc tac gcc 201
Pro His Phe Ser Pro Leu Ala Phe Gly Pro Glu Gln Ala Phe Tyr Ala
35 40 45

acc gcc gag agc gtc cgc gac cac ctc ctc cag aga tgg aac gac acc 249

Thr Ala Glu Ser Val Arg Asp His Leu Leu Gln Arg Trp Asn Asp Thr
 50 55 60

tac ctg cat ttc cac aag acg gat ccc aag cag acc tac tac ctc tcc 297
 Tyr Leu His Phe His Lys Thr Asp Pro Lys Gln Thr Tyr Tyr Leu Ser
 65 70 75 80

atg gag tac ctg cag ggc cgc gcg ctc acc aac gcc gtc ggc aac ctc 345
 Met Glu Tyr Leu Gln Gly Arg Ala Leu Thr Asn Ala Val Gly Asn Leu
 85 90 95

gcc atc acc ggc gcc tac gct gac gcc ctg aag aag ttc ggc tac gag 393
 Ala Ile Thr Gly Ala Tyr Ala Asp Ala Leu Lys Lys Phe Gly Tyr Glu
 100 105 110

ctc gag gcc atc gct gga cag gag aga gat gcg gct ctg gga aat ggt 441
 Leu Glu Ala Ile Ala Gly Gln Glu Arg Asp Ala Ala Leu Gly Asn Gly
 115 120 125

ggc ttg ggc agg ctt gca tct tgc ttt ttg gat tca atg gca acg ctg 489
 Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu
 130 135 140

aac ttg cct tct tgg ggc tat ggc ctt cgt tac cgt tat ggc ctg ttc 537
 Asn Leu Pro Ser Trp Gly Tyr Gly Leu Arg Tyr Arg Tyr Gly Leu Phe
 145 150 155 160

aag cag cgc att gcc aag gaa gga caa gaa gaa atc gct gaa gat tgg 585
 Lys Gln Arg Ile Ala Lys Glu Gly Gln Glu Glu Ile Ala Glu Asp Trp
 165 170 175

ctt gat aag ttt agc cca tgg gag att gtc agg cat gat gtt gta tac 633
 Leu Asp Lys Phe Ser Pro Trp Glu Ile Val Arg His Asp Val Val Tyr
 180 185 190

cca atc aga ttt ttc ggc cat gtc gag att tcg cca gat gga aag cgg 681
 Pro Ile Arg Phe Phe Gly His Val Glu Ile Ser Pro Asp Gly Lys Arg
 195 200 205

aaa tgg gcc ggt gga gaa gtt ctg aac gct tta gcc tat gat gtg cca 729
 Lys Trp Ala Gly Gly Glu Val Leu Asn Ala Leu Ala Tyr Asp Val Pro
 210 215 220

att cct ggg tac aag aca aaa aat gca atc agt ctt cgc ctt tgg gat 777
 Ile Pro Gly Tyr Lys Thr Lys Asn Ala Ile Ser Leu Arg Leu Trp Asp
 225 230 235 240

gca aca gct act gct gag gat ttc aac tta ttt cag ttc aat gat ggc 825
 Ala Thr Ala Thr Ala Glu Asp Phe Asn Leu Phe Gln Phe Asn Asp Gly
 245 250 255

cag tat gag tca gct gca ctt cac tcg agg gca cag cag ata tgt 873
 Gln Tyr Glu Ser Ala Ala Gln Leu His Ser Arg Ala Gln Gln Ile Cys
 260 265 270

gct gtt ctc tat ccc ggt gat gct aca gaa gaa ggg aag ctt ctg aga 921
 Ala Val Leu Tyr Pro Gly Asp Ala Thr Glu Glu Gly Lys Leu Leu Arg
 275 280 285

tta aag cag cag tat ttc ctt tgc agc gca tca ctt cag gat att att 969

Leu Lys Gln Gln Tyr Phe Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile
290 295 300

ttc aga ttt aaa gaa aga aaa gct gac aga gtt tca ggg aag tgg agt 1017
Phe Arg Phe Lys Glu Arg Lys Ala Asp Arg Val Ser Gly Lys Trp Ser
305 310 315 320

gag ttc cct tcc aaa gtt gct caa atg aat gac act cat cca act 1065
Glu Phe Pro Ser Lys Val Ala Val Gln Met Asn Asp Thr His Pro Thr
325 330 335

ctt gcc att cct gag cta atg agg ttg ctt atg gac gtc gag gga ctt 1113
Leu Ala Ile Pro Glu Leu Met Arg Leu Leu Met Asp Val Glu Gly Leu
340 345 350

ggt tgg gac gaa gcc tgg gct gtc aca aat aag acg gtt gct tac acc 1161
Gly Trp Asp Glu Ala Trp Ala Val Thr Asn Lys Thr Val Ala Tyr Thr
355 360 365

aat cac acg gtt ctt cct gaa gct ctt gag aaa tgg tca cag gct gta 1209
Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Gln Ala Val
370 375 380

atg aag aaa ttg ctt cca cgt cac atg gaa atc att gag gaa att gac 1257
Met Lys Lys Leu Leu Pro Arg His Met Glu Ile Ile Glu Glu Ile Asp
385 390 395 400

aag cgg ttt aga gaa atg gta atc tcc acc cgg aag gat atg gag gga 1305
Lys Arg Phe Arg Glu Met Val Ile Ser Thr Arg Lys Asp Met Glu Gly
405 410 415

aag atc gaa tcg atg agg gtt tta gat aac aat ccc gag aag cca gta 1353
Lys Ile Glu Ser Met Arg Val Leu Asp Asn Asn Pro Glu Lys Pro Val
420 425 430

gtg cgg atg gcg aat ttg tgt gtt gtg gct ggg cat acg gtg aat gga 1401
Val Arg Met Ala Asn Leu Cys Val Val Ala Gly His Thr Val Asn Gly
435 440 445

gtg gcc gag ttg cac acg aac atc ttg aaa caa gag ctg ttt gca gat 1449
Val Ala Glu Leu His Ser Asn Ile Leu Lys Gln Glu Leu Phe Ala Asp
450 455 460

tat gtc tct att tgg cct aac aaa ttc cag aac aaa act aat gga att 1497
Tyr Val Ser Ile Trp Pro Asn Lys Phe Gln Asn Lys Thr Asn Gly Ile
465 470 475 480

aca cca cgt aga tgg ctc cgt ttt tgc aac cct gag ttg agt gaa ata 1545
Thr Pro Arg Arg Trp Leu Arg Phe Cys Asn Pro Glu Leu Ser Glu Ile
485 490 495

gtc act aaa tgg cta aaa aca gat cag tgg aca agc aac ctt gat ctt 1593
Val Thr Lys Trp Leu Lys Thr Asp Gln Trp Thr Ser Asn Leu Asp Leu
500 505 510

ctc acc ggg ctt cgg aaa ttc gca gat gat gaa aaa cta cat gct gag 1641
Leu Thr Gly Leu Arg Lys Phe Ala Asp Asp Glu Lys Leu His Ala Glu
515 520 525

tgg gca gca gcc aag ctg gcc agc aaa aag cgc cta gcc aag cat gta 1689

Trp Ala Ala Ala Lys Leu Ala Ser Lys Lys Arg Leu Ala Lys His Val
530 535 540

ttg gat gtg act ggt gtt aca att gac cca gat agc ctt ttt gat ata 1737
Leu Asp Val Thr Gly Val Thr Ile Asp Pro Asp Ser Leu Phe Asp Ile
545 550 555 560

caa att aaa cgc atc cac gaa tac aag aga cag ctg atg aac att ttg 1785
Gln Ile Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Met Asn Ile Leu
565 570 575

gga gct gtg tac aga tac aag aag tta aag gaa atg agc gca gca gac 1833
Gly Ala Val Tyr Arg Tyr Lys Lys Leu Lys Glu Met Ser Ala Ala Asp
580 585 590

agg cag aag gtt aca ccg cgc act gtc atg gta gga ggg aaa gca ttt 1881
Arg Gln Lys Val Thr Pro Arg Thr Val Met Val Gly Gly Lys Ala Phe
595 600 605

gca aca tac acc aac gcc aaa aga ata gtg aaa ttg gta aat gat gtt 1929
Ala Thr Tyr Thr Asn Ala Lys Arg Ile Val Lys Leu Val Asn Asp Val
610 615 620

ggt gct gtg gtg aac aac gat gct gac gtc aac aaa tat ctg aag gtg 1977
Gly Ala Val Val Asn Asn Asp Ala Asp Val Asn Lys Tyr Leu Lys Val
625 630 635 640

gtg ttc att cca aac tac aat gta tca gtg gct gaa gtg ctc att cct 2025
Val Phe Ile Pro Asn Tyr Asn Val Ser Val Ala Glu Val Leu Ile Pro
645 650 655

ggc agt gaa ctg tca cag cac atc agt act gca ggc atg gaa gca agt 2073
Gly Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser
660 665 670

gga aca agt aac atg aag ttc tct ctg aat ggc tgt gtt atc att gga 2121
Gly Thr Ser Asn Met Lys Phe Ser Leu Asn Gly Cys Val Ile Ile Gly
675 680 685

act ctc gat gga gcc aat gtt gaa atc aga gaa gaa gtg gga caa gac 2169
Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Val Gly Gln Asp
690 695 700

aac ttc ttc ctt ttc ggt gcc aaa gca gat cag gtt gct ggt ctg agg 2217
Asn Phe Phe Leu Phe Gly Ala Lys Ala Asp Gln Val Ala Gly Leu Arg
705 710 715 720

aag gat aga gaa aat ggc ttg ttc aag cca gac cca cgc ttc gaa gaa 2265
Lys Asp Arg Glu Asn Gly Leu Phe Lys Pro Asp Pro Arg Phe Glu Glu
725 730 735

gcc aag cag ttt atc agg agt ggt gct ttc ggc acc tac gac tac act 2313
Ala Lys Gln Phe Ile Arg Ser Gly Ala Phe Gly Thr Tyr Asp Tyr Thr
740 745 750

cct ctc ttg gat tcc ctt gaa ggg aac act gga ttt ggg cgt ggt gac 2361
Pro Leu Leu Asp Ser Leu Glu Gly Asn Thr Gly Phe Gly Arg Gly Asp
755 760 765

tac ttc ctt gtt ggc tat gac ttt cca agc tac att gat gca cag gcc 2409

Tyr Phe Leu Val Gly Tyr Asp Phe Pro Ser Tyr Ile Asp Ala Gln Ala
770 775 780

cgg gtt gat gaa gcc tac aag gac aag aag aaa tgg gtc aag atg tcc 2457
Arg Val Asp Glu Ala Tyr Lys Asp Lys Lys Trp Val Lys Met Ser
785 790 795 800

atc ttg aac acg gct gga agc ggc aag ttc agc agc gac cgc acc atc 2505
Ile Leu Asn Thr Ala Gly Ser Gly Lys Phe Ser Ser Asp Arg Thr Ile
805 810 815

gac caa tat gcg aag gag atc tgg ggc att tcg gct tgc cct gtt cca 2553
Asp Gln Tyr Ala Lys Glu Ile Trp Gly Ile Ser Ala Cys Pro Val Pro
820 825 830

tga agaggagacg tcatcaagag gtatggatg atatgcgtg gcagtaataa 2606

ggacctata ctggccatg gtataacc cctgctccg ttgttagctga gaagaatgaa 2666

gcaacgtacg aagcctgtt ttttgttat tctgctgcac ttttgaagt catagaggat 2726

gcgactttc ttttgttctt ttctttttt ggtctgtaac catactattt tcatcctgaa 2786

ccgaaatggc ggaatcatcc aggttctcaa taaaatagtt caagtttga taaaaaaaaa 2846

aaaaaaaaaaaa 2856

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<212> PRT
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<400> 20

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Asp Pro Ser Ala Ile Ala Gly Asn Ile Ser Tyr His Ala Gln Tyr Ser
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Pro His Phe Ser Pro Leu Ala Phe Gly Pro Glu Gln Ala Phe Tyr Ala
35 40 45

Thr Ala Glu Ser Val Arg Asp His Leu Leu Gln Arg Trp Asn Asp Thr
50 55 60

Tyr Leu His Phe His Lys Thr Asp Pro Lys Gln Thr Tyr Tyr Leu Ser
65 70 75 80

Met Glu Tyr Leu Gln Gly Arg Ala Leu Thr Asn Ala Val Gly Asn Leu
85 90 95

Ala Ile Thr Gly Ala Tyr Ala Asp Ala Leu Lys Lys Phe Gly Tyr Glu

100

105

110

Leu Glu Ala Ile Ala Gly Gln Glu Arg Asp Ala Ala Leu Gly Asn Gly
115 120 125

Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu
130 135 140

Asn Leu Pro Ser Trp Gly Tyr Gly Leu Arg Tyr Arg Tyr Gly Leu Phe
145 150 155 160

Lys Gln Arg Ile Ala Lys Glu Gly Gln Glu Glu Ile Ala Glu Asp Trp
165 170 175

Leu Asp Lys Phe Ser Pro Trp Glu Ile Val Arg His Asp Val Val Tyr
180 185 190

Pro Ile Arg Phe Phe Gly His Val Glu Ile Ser Pro Asp Gly Lys Arg
195 200 205

Lys Trp Ala Gly Gly Glu Val Leu Asn Ala Leu Ala Tyr Asp Val Pro
210 215 220

Ile Pro Gly Tyr Lys Thr Lys Asn Ala Ile Ser Leu Arg Leu Trp Asp
225 230 235 240

Ala Thr Ala Thr Ala Glu Asp Phe Asn Leu Phe Gln Phe Asn Asp Gly
245 250 255

Gln Tyr Glu Ser Ala Ala Gln Leu His Ser Arg Ala Gln Gln Ile Cys
260 265 270

Ala Val Leu Tyr Pro Gly Asp Ala Thr Glu Glu Gly Lys Leu Leu Arg
275 280 285

Leu Lys Gln Gln Tyr Phe Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile
290 295 300

Phe Arg Phe Lys Glu Arg Lys Ala Asp Arg Val Ser Gly Lys Trp Ser
305 310 315 320

Glu Phe Pro Ser Lys Val Ala Val Gln Met Asn Asp Thr His Pro Thr
325 330 335

Leu Ala Ile Pro Glu Leu Met Arg Leu Leu Met Asp Val Glu Gly Leu

340

345

350

Gly Trp Asp Glu Ala Trp Ala Val Thr Asn Lys Thr Val Ala Tyr Thr
355 360 365

Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Gln Ala Val
370 375 380

Met Lys Lys Leu Leu Pro Arg His Met Glu Ile Ile Glu Glu Ile Asp
385 390 395 400

Lys Arg Phe Arg Glu Met Val Ile Ser Thr Arg Lys Asp Met Glu Gly
405 410 415

Lys Ile Glu Ser Met Arg Val Leu Asp Asn Asn Pro Glu Lys Pro Val
420 425 430

Val Arg Met Ala Asn Leu Cys Val Val Ala Gly His Thr Val Asn Gly
435 440 445

Val Ala Glu Leu His Ser Asn Ile Leu Lys Gln Glu Leu Phe Ala Asp
450 455 460

Tyr Val Ser Ile Trp Pro Asn Lys Phe Gln Asn Lys Thr Asn Gly Ile
465 470 475 480

Thr Pro Arg Arg Trp Leu Arg Phe Cys Asn Pro Glu Leu Ser Glu Ile
485 490 495

Val Thr Lys Trp Leu Lys Thr Asp Gln Trp Thr Ser Asn Leu Asp Leu
500 505 510

Leu Thr Gly Leu Arg Lys Phe Ala Asp Asp Glu Lys Leu His Ala Glu
515 520 525

Trp Ala Ala Ala Lys Leu Ala Ser Lys Lys Arg Leu Ala Lys His Val
530 535 540

Leu Asp Val Thr Gly Val Thr Ile Asp Pro Asp Ser Leu Phe Asp Ile
545 550 555 560

Gln Ile Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Met Asn Ile Leu
565 570 575

Gly Ala Val Tyr Arg Tyr Lys Leu Lys Glu Met Ser Ala Ala Asp

580

585

590

Arg Gln Lys Val Thr Pro Arg Thr Val Met Val Gly Gly Lys Ala Phe
595 600 605

Ala Thr Tyr Thr Asn Ala Lys Arg Ile Val Lys Leu Val Asn Asp Val
610 615 620

Gly Ala Val Val Asn Asn Asp Ala Asp Val Asn Lys Tyr Leu Lys Val
625 630 635 640

Val Phe Ile Pro Asn Tyr Asn Val Ser Val Ala Glu Val Leu Ile Pro
645 650 655

Gly Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met Glu Ala Ser
660 665 670

Gly Thr Ser Asn Met Lys Phe Ser Leu Asn Gly Cys Val Ile Ile Gly
675 680 685

Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Val Gly Gln Asp
690 695 700

Asn Phe Phe Leu Phe Gly Ala Lys Ala Asp Gln Val Ala Gly Leu Arg
705 710 715 720

Lys Asp Arg Glu Asn Gly Leu Phe Lys Pro Asp Pro Arg Phe Glu Glu
725 730 735

Ala Lys Gln Phe Ile Arg Ser Gly Ala Phe Gly Thr Tyr Asp Tyr Thr
740 745 750

Pro Leu Leu Asp Ser Leu Glu Gly Asn Thr Gly Phe Gly Arg Gly Asp
755 760 765

Tyr Phe Leu Val Gly Tyr Asp Phe Pro Ser Tyr Ile Asp Ala Gln Ala
770 775 780

Arg Val Asp Glu Ala Tyr Lys Asp Lys Lys Trp Val Lys Met Ser
785 790 795 800

Ile Leu Asn Thr Ala Gly Ser Gly Lys Phe Ser Ser Asp Arg Thr Ile
805 810 815

Asp Gln Tyr Ala Lys Glu Ile Trp Gly Ile Ser Ala Cys Pro Val Pro

820

825

830

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Ala Lys Ala Asn Gly Lys Asn Glu Ala Ala Lys Leu Ala Lys Ile Pro
5 10 15

gcg gct gcg aat cca ttg gct aat gaa cca tcg gcg att gca tca aat 152
Ala Ala Ala Asn Pro Leu Ala Asn Glu Pro Ser Ala Ile Ala Ser Asn
20 25 30 35

ata agt tac cac gtg cag tac agt cct cat ttc tcg ccg act aag ttc 200
Ile Ser Tyr His Val Gln Tyr Ser Pro His Phe Ser Pro Thr Lys Phe
40 45 50

gag ccg gag caa gct ttc ttt gcc acg gcg gag gtt gtc ccg gat cgt 248
Glu Pro Glu Gln Ala Phe Phe Ala Thr Ala Glu Val Val Arg Asp Arg
55 60 65

ctt att caa caa tgg aat gag aca tac cac cat ttt aat aaa gtt gat 296
Leu Ile Gln Gln Trp Asn Glu Thr Tyr His His Phe Asn Lys Val Asp
70 75 80

ccg aag caa aca tac tac cta tca atg gaa ttt ctt caa gga agg act 344
Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly Arg Thr
85 90 95

ttg act aat gca att ggc agt ttg gac att cag aat gca tat gct gat 392
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100 105 110 115

gct tta aat aat ttg ggg cat gtc ctt gag gag ata gct gaa cag gaa 440
Ala Leu Asn Asn Leu Gly His Val Leu Glu Glu Ile Ala Glu Gln Glu
120 125 130

aaa gat gct gca cta gga aat ggt ggg ctg ggc agg cta gct tca tgc 488
Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser Cys
135 140 145

ttc tta gac tcc atg gca aca ttg aat ttg cct gca tgg ggt tat ggt 536
Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr Gly
150 155 160

ttg aga tac cgg tat ggg ctg ttc aag cag aag atc acc aag cag ggt 584
Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Lys Ile Thr Lys Gln Gly

165 170 175
caa gaa gaa gtt gct gaa gat tgg ctt gag aaa ttt agt cct tgg gaa 632
Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp Glu
180 185 190 195
gtt gtc agg cat gat gtg gta ttt ccg gtc aga ttt ttt ggg agt gtt 680
Val Val Arg His Asp Val Val Phe Pro Val Arg Phe Phe Gly Ser Val
200 205 210
atg gtt aat cca aat gga acg aga aaa tgg gtt ggg ggt gaa gtt gtc 728
Met Val Asn Pro Asn Gly Thr Arg Lys Trp Val Gly Gly Glu Val Val
215 220 225
caa gcc gta gct tat gat ata cca att cca ggg tac aaa acc aag aac 776
Gln Ala Val Ala Tyr Asp Ile Pro Gly Tyr Lys Thr Lys Asn
230 235 240
act atc agt ctt cgt ctc tgg gac gct aaa gct agc gct gag gat ttc 824
Thr Ile Ser Leu Arg Leu Trp Asp Ala Lys Ala Ser Ala Glu Asp Phe
245 250 255
aat tta ttt cag ttt aat gat gga caa tac gaa tct gct gca cag ctt 872
Asn Leu Phe Gln Phe Asn Asp Gly Gln Tyr Glu Ser Ala Ala Gln Leu
260 265 270 275
cat tct cga gct caa cag att tgt gct gtc tac ccc ggg gat tct 920
His Ser Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro Gly Asp Ser
280 285 290
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Ser Ala Ser Leu Gln Asp Met Ile Leu Arg Phe Lys Glu Arg Lys Ser
310 315 320
gga agg cag tgg tct gaa ttt ccc agc aag gta gct gta caa ctg aat 1064
Gly Arg Gln Trp Ser Glu Phe Pro Ser Lys Val Ala Val Gln Leu Asn
325 330 335
gat act cat cca aca ctt gca att cca gag ttg atg cga ttg cta atg 1112
Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met Arg Leu Leu Met
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gat gag gaa gga ctt gga tgg gat gaa gca tgg gat ata aca aca agg 1160
Asp Glu Glu Gly Leu Gly Trp Asp Glu Ala Trp Asp Ile Thr Thr Arg
360 365 370
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Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys
375 380 385
tgg tca caa gca gta atg tgg aag ctt ctt cct cgc cat atg gaa ata 1256
Trp Ser Gln Ala Val Met Trp Lys Leu Leu Pro Arg His Met Glu Ile
390 395 400
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Ile Glu Glu Ile Asp Lys Arg Phe Ile Ala Met Val Arg Ser Thr Arg

405	410	415													
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Ser	Asp	Leu	Glu	Ser	Lys	Ile	Pro	Ser	Met	Cys	Ile	Leu	Asp	Asn	Asn
420	425	430	435												
ccc aaa aag ccg gtt gtt agg atg gca aac tta tgt gta tct gcg 1400															
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470	475	480													
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485	490	495													
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Thr	Asn	Leu	Asp	Leu	Leu	Val	Gly	Leu	Arg	Gln	Phe	Ala	Asp	Asn	Thr
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Leu	Ala	Asp	Tyr	Ile	Trp	Arg	Val	Thr	Gly	Val	Thr	Ile	Asp	Pro	Asn
550	555	560													
agc tta ttt gac ata caa gtc aag cgc att cat gaa tac aag aga caa 1784															
Ser	Leu	Phe	Asp	Ile	Gln	Val	Lys	Arg	Ile	His	Glu	Tyr	Lys	Arg	Gln
565	570	575													
ctg cta aat att ttg ggc gca atc tac aga tac aag aag ttg aag gag 1832															
Leu	Leu	Asn	Ile	Leu	Gly	Ala	Ile	Tyr	Arg	Tyr	Lys	Lys	Leu	Lys	Glu
580	585	590	595												
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Met	Ser	Pro	Gln	Glu	Arg	Lys	Lys	Thr	Thr	Pro	Arg	Thr	Ile	Met	Phe
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615	620	625													
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Leu	Val	Asn	Asp	Val	Gly	Glu	Val	Val	Asn	Thr	Asp	Pro	Glu	Val	Asn
630	635	640													
agt tat ttg aag gtg gta ttt gtt cca aat tac aat gtc tct gtt gcg 2024															
Ser	Tyr	Leu	Lys	Val	Val	Phe	Val	Pro	Asn	Tyr	Asn	Val	Ser	Val	Ala

645 650 655

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660 665 670 675

ggc atg gag gca agt ggc aca aac atg aaa ttt tct cta aat ggt 2120
Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ser Leu Asn Gly
680 685 690

tgc ctc att ata gga aca ttg gat gga gct aat gtg gaa atc agg cag 2168
Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Gln
695 700 705

gag ata gga gag gag aat ttc ttt ctc ttt ggt gca gga gca gac caa 2216
Glu Ile Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Gly Ala Asp Gln
710 715 720

gtc cct aag ctg cgg aag gaa aga gaa gat gga ttg ttc aaa cca gat 2264
Val Pro Lys Leu Arg Lys Glu Arg Glu Asp Gly Leu Phe Lys Pro Asp
725 730 735

cct cgg ttt gaa gag gcc aag caa ttt ata aga agt gga gca ttt gga 2312
Pro Arg Phe Glu Glu Ala Lys Gln Phe Ile Arg Ser Gly Ala Phe Gly
740 745 750 755

agc tat gac tac aac ccg ctt ctt gat tcc ctg gag ggg aac act ggt 2360
Ser Tyr Asp Tyr Asn Pro Leu Leu Asp Ser Leu Glu Gly Asn Thr Gly
760 765 770

tat ggt cgt ggt gat tat ttt cta gtt ggt tat gac ttc cca agt tac 2408
Tyr Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp Phe Pro Ser Tyr
775 780 785

tta gag gct cag gac aga gtt gac caa gct tac aag gac cgg aag aag 2456
Leu Glu Ala Gln Asp Arg Val Asp Gln Ala Tyr Lys Asp Arg Lys Lys
790 795 800

tgg ctg aag atg tct ata tta agt aca gct ggc agt ggg aaa ttc agc 2504
Trp Leu Lys Met Ser Ile Leu Ser Thr Ala Gly Ser Gly Lys Phe Ser
805 810 815

agt gat cgc aca att gca cag tat gct aag gaa atc tgg aac ata aca 2552
Ser Asp Arg Thr Ile Ala Gln Tyr Ala Lys Glu Ile Trp Asn Ile Thr
820 825 830 835

gaa tgc cgt aca tca tga ttcaagtgc aaaaaatttc atgtgcataa 2600
Glu Cys Arg Thr Ser
840

ggttatataa tttcttgaa ggatgttata agatggaaag aaaatgaaag gaaatccaca 2660

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acatcgctct gtcagataag tttaagtgtt taatttctta aacaattctta tctttataag 2780

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<212> PRT
<213> Citrus hybrid cultivar

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35 40 45

Thr Lys Phe Glu Pro Glu Gln Ala Phe Phe Ala Thr Ala Glu Val Val
50 55 60

Arg Asp Arg Leu Ile Gln Gln Trp Asn Glu Thr Tyr His His Phe Asn
65 70 75 80

Lys Val Asp Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Phe Leu Gln
85 90 95

Gly Arg Thr Leu Thr Asn Ala Ile Gly Ser Leu Asp Ile Gln Asn Ala
100 105 110

Tyr Ala Asp Ala Leu Asn Asn Leu Gly His Val Leu Glu Glu Ile Ala
115 120 125

Glu Gln Glu Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu
130 135 140

Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp
145 150 155 160

Gly Tyr Gly Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Lys Ile Thr
165 170 175

Lys Gln Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Lys Phe Ser
180 185 190

Pro Trp Glu Val Val Arg His Asp Val Val Phe Pro Val Arg Phe Phe
195 200 205

Gly Ser Val Met Val Asn Pro Asn Gly Thr Arg Lys Trp Val Gly Gly
210 215 220

Glu Val Val Gln Ala Val Ala Tyr Asp Ile Pro Ile Pro Gly Tyr Lys
225 230 235 240

Thr Lys Asn Thr Ile Ser Leu Arg Leu Trp Asp Ala Lys Ala Ser Ala
245 250 255

Glu Asp Phe Asn Leu Phe Gln Phe Asn Asp Gly Gln Tyr Glu Ser Ala
260 265 270

Ala Gln Leu His Ser Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro
275 280 285

Gly Asp Ser Thr Glu Glu Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe
290 295 300

Phe Leu Cys Ser Ala Ser Leu Gln Asp Met Ile Leu Arg Phe Lys Glu
305 310 315 320

Arg Lys Ser Gly Arg Gln Trp Ser Glu Phe Pro Ser Lys Val Ala Val
325 330 335

Gln Leu Asn Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met Arg
340 345 350

Leu Leu Met Asp Glu Glu Gly Leu Gly Trp Asp Glu Ala Trp Asp Ile
355 360 365

Thr Thr Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala
370 375 380

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385 390 395 400

Met Glu Ile Ile Glu Glu Ile Asp Lys Arg Phe Ile Ala Met Val Arg
405 410 415

Ser Thr Arg Ser Asp Leu Glu Ser Lys Ile Pro Ser Met Cys Ile Leu
420 425 430

Asp Asn Asn Pro Lys Lys Pro Val Val Arg Met Ala Asn Leu Cys Val
435 440 445

Val Ser Ala His Thr Val Asn Gly Val Ala Gln Leu His Ser Asp Ile
450 455 460

Leu Lys Ala Asp Leu Phe Ala Asp Tyr Val Ser Leu Trp Pro Asn Lys
465 470 475 480

Leu Gln Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Leu Arg Phe
485 490 495

Cys Asn Pro Glu Leu Ser Lys Ile Ile Thr Lys Trp Leu Lys Thr Asp
500 505 510

Gln Trp Val Thr Asn Leu Asp Leu Leu Val Gly Leu Arg Gln Phe Ala
515 520 525

Asp Asn Thr Glu Leu Gln Ala Glu Trp Glu Ser Ala Lys Met Ala Ser
530 535 540

Lys Lys His Leu Ala Asp Tyr Ile Trp Arg Val Thr Gly Val Thr Ile
545 550 555 560

Asp Pro Asn Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His Glu Tyr
565 570 575

Lys Arg Gln Leu Leu Asn Ile Leu Gly Ala Ile Tyr Arg Tyr Lys Lys
580 585 590

Leu Lys Glu Met Ser Pro Gln Glu Arg Lys Lys Thr Thr Pro Arg Thr
595 600 605

Ile Met Phe Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys Arg
610 615 620

Ile Val Lys Leu Val Asn Asp Val Gly Glu Val Val Asn Thr Asp Pro
625 630 635 640

Glu Val Asn Ser Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn Val
645 650 655

Ser Val Ala Glu Leu Leu Ile Pro Gly Ser Glu Leu Ser Gln His Ile
660 665 670

Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ser
675 680 685

Leu Asn Gly Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val Glu
690 695 700

Ile Arg Gln Glu Ile Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Gly
705 710 715 720

Ala Asp Gln Val Pro Lys Leu Arg Lys Glu Arg Glu Asp Gly Leu Phe
725 730 735

Lys Pro Asp Pro Arg Phe Glu Glu Ala Lys Gln Phe Ile Arg Ser Gly
740 745 750

Ala Phe Gly Ser Tyr Asp Tyr Asn Pro Leu Leu Asp Ser Leu Glu Gly
755 760 765

Asn Thr Gly Tyr Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp Phe
770 775 780

Pro Ser Tyr Leu Glu Ala Gln Asp Arg Val Asp Gln Ala Tyr Lys Asp
785 790 795 800

Arg Lys Lys Trp Leu Lys Met Ser Ile Leu Ser Thr Ala Gly Ser Gly
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Pro Ala Ala Ser Pro Ala Ser Glu Glu Pro Ala Ala Ile Ala Gly Asn
20 25 30

atc tcc ttc cac gcg cag tac agc ccc cac ttc tcg ccg ctc gcg ttc 144

Ile Ser Phe His Ala Gln Tyr Ser Pro His Phe Ser Pro Leu Ala Phe

35 40 45

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Gly Pro Glu Gln Ala Phe Tyr Ser Thr Ala Glu Ser Val Arg Asp His
50 55 60

ctc gtc cag aga tgg aac gag acg tac ttg cat ttc cac aag acg gat 240
Leu Val Gln Arg Trp Asn Glu Thr Tyr Leu His Phe His Lys Thr Asp
65 70 75 80

ccg aag cag acg tac tac ctc tcc atg gag tac ctg cag ggc cgc gcg 288
Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg Ala
85 90 95

ctc acc aac gcc gtc ggc aac ctc ggc atc acc ggc gcc tac gcg gag 336
Leu Thr Asn Ala Val Gly Asn Leu Gly Ile Thr Gly Ala Tyr Ala Glu
100 105 110

gcc gtg aag aag ttc ggg tac gag ctc gag gcc ctc gtc ggg cag gaa 384
Ala Val Lys Lys Phe Gly Tyr Glu Leu Glu Ala Leu Val Gly Gln Glu
115 120 125

aaa gat gca gct ctg gga aat ggt ggc ttg ggt agg ctc gca tct tgc 432
Lys Asp Ala Ala Leu Gly Asn Gly Leu Gly Arg Leu Ala Ser Cys
130 135 140

ttt ttg gat tcg atg gca aca cta aat ttg cct gct tgg gga tat ggt 480
Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr Gly
145 150 155 160

ctg cgg tac cga tat ggt cta ttc aaa caa tgc atc acc aag gaa ggc 528
Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Cys Ile Thr Lys Glu Gly
165 170 175

cag gaa gaa att gct gaa gat tgg ctt gag aag ttc agc cca tgg gaa 576
Gln Glu Glu Ile Ala Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp Glu
180 185 190

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Ile Val Arg His Asp Ile Val Tyr Pro Ile Arg Phe Phe Gly His Val
195 200 205

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Glu Ile Leu Pro Asp Gly Ser Arg Lys Trp Val Gly Gly Glu Val Leu
210 215 220

aat gct tta gca tat gat gtc cca att cct ggg tac aag aca aaa aat 720
Asn Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Lys Thr Lys Asn
225 230 235 240

gca atc agt ctt cgt ctt tgg gac gca aaa gct agt gcg gag gat ttt 768
Ala Ile Ser Leu Arg Leu Trp Asp Ala Lys Ala Ser Ala Glu Asp Phe
245 250 255

aac tta ttt caa ttc aat gat ggc cag tat gag tcc gct gct caa ctt 816
Asn Leu Phe Gln Phe Asn Asp Gly Gln Tyr Glu Ser Ala Ala Gln Leu
260 265 270

cat gct agg gca caa cag ata tgt gcc gtt ctc tat ccc ggt gat gct 864

His Ala Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro Gly Asp Ala
275 280 285

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290 295 300

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Ser Ala Ser Leu Gln Asp Ile Phe Phe Arg Phe Lys Glu Arg Lys Ala
305 310 315 320

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Asp Arg Val Ser Gly Lys Trp Ser Glu Phe Pro Ala Lys Val Ala Val
325 330 335

caa ttg aat gac act cac cca act ctt gcg att cct gag ctg atg agg 1056
Gln Leu Asn Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met Arg
340 345 350

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370 375 380

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385 390 395 400

atg gaa att atc gag gaa att gac aag cgg ttc aag gaa atg gta atc 1248
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405 410 415

tcc acc cgg aag gaa atg gag gga aag att gac tcc atg aga atc tta 1296
Ser Thr Arg Lys Glu Met Glu Gly Lys Ile Asp Ser Met Arg Ile Leu
420 425 430

gac aac tca aat cct cag aag cca gta gtg cgc atg gca aat ttg tgc 1344
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435 440 445

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450 455 460

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485 490 495

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500 505 510

gat cag tgg aca agc aac ctt gat ctt ctt acc gga ctt cgg aaa ttt 1584

Asp Gln Trp Thr Ser Asn Leu Asp Leu Leu Thr Gly Leu Arg Lys Phe
515 520 525

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530 535 540

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Ser Lys Lys Arg Leu Ala Lys His Val Leu Asp Val Thr Gly Val Thr
545 550 555 560

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Ile Asp Pro Asn Ser Leu Phe Asp Ile Gln Ile Lys Arg Ile His Glu
565 570 575

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580 585 590

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595 600 605

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Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys
610 615 620

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Arg Ile Val Lys Leu Val Asn Asp Val Gly Ala Val Val Asn Asn Asp
625 630 635 640

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Pro Asp Val Asn Lys Tyr Leu Lys Val Val Phe Ile Pro Asn Tyr Asn
645 650 655

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Val Ser Val Ala Glu Val Leu Ile Pro Gly Ser Glu Leu Ser Gln His
660 665 670

atc agt acc gca ggc atg gaa gca agt gga acg agt aat atg aaa ttc 2064
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675 680 685

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690 695 700

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705 710 715 720

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725 730 735

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740 745 750

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755 760 765

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770 775 780

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Phe Pro Ser Tyr Ile Asp Ala Gln Ala Gln Val Asp Glu Ala Tyr Lys
785 790 795 800

gat aag aaa aaa tgg atc aag atg tct ata ctg aac aca gct gga agt 2448
Asp Lys Lys Lys Trp Ile Lys Met Ser Ile Leu Asn Thr Ala Gly Ser
805 810 815

ggc aaa ttc agc agc gac cgt act atc gct cag tat gca aag gaa ata 2496
Gly Lys Phe Ser Ser Asp Arg Thr Ile Ala Gln Tyr Ala Lys Glu Ile
820 825 830

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Trp Gly Ile Thr Ala Ser Pro Val Ser
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35 40 45

Gly Pro Glu Gln Ala Phe Tyr Ser Thr Ala Glu Ser Val Arg Asp His
50 55 60

Leu Val Gln Arg Trp Asn Glu Thr Tyr Leu His Phe His Lys Thr Asp
65 70 75 80

Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg Ala
85 90 95

Leu Thr Asn Ala Val Gly Asn Leu Gly Ile Thr Gly Ala Tyr Ala Glu
100 105 110

Ala Val Lys Lys Phe Gly Tyr Glu Leu Glu Ala Leu Val Gly Gln Glu

115

120

125

Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser Cys
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Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr Gly
145 150 155 160

Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Cys Ile Thr Lys Glu Gly
165 170 175

Gln Glu Glu Ile Ala Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp Glu
180 185 190

Ile Val Arg His Asp Ile Val Tyr Pro Ile Arg Phe Phe Gly His Val
195 200 205

Glu Ile Leu Pro Asp Gly Ser Arg Lys Trp Val Gly Gly Glu Val Leu
210 215 220

Asn Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Lys Thr Lys Asn
225 230 235 240

Ala Ile Ser Leu Arg Leu Trp Asp Ala Lys Ala Ser Ala Glu Asp Phe
245 250 255

Asn Leu Phe Gln Phe Asn Asp Gly Gln Tyr Glu Ser Ala Ala Gln Leu
260 265 270

His Ala Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro Gly Asp Ala
275 280 285

Thr Glu Glu Gly Lys Leu Leu Arg Leu Lys Gln Gln Tyr Phe Leu Cys
290 295 300

Ser Ala Ser Leu Gln Asp Ile Phe Phe Arg Phe Lys Glu Arg Lys Ala
305 310 315 320

Asp Arg Val Ser Gly Lys Trp Ser Glu Phe Pro Ala Lys Val Ala Val
325 330 335

Gln Leu Asn Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met Arg
340 345 350

Leu Leu Met Asp Val Glu Gly Leu Gly Trp Asp Glu Ala Trp Asp Ile

355 360 365

Thr Asn Lys Thr Ile Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala
370 375 380

Leu Glu Lys Trp Ser Gln Ile Val Met Arg Lys Leu Leu Pro Arg His
385 390 395 400

Met Glu Ile Ile Glu Glu Ile Asp Lys Arg Phe Lys Glu Met Val Ile
405 410 415

Ser Thr Arg Lys Glu Met Glu Gly Lys Ile Asp Ser Met Arg Ile Leu
420 425 430

Asp Asn Ser Asn Pro Gln Lys Pro Val Val Arg Met Ala Asn Leu Cys
435 440 445

Val Val Ser Ala His Thr Val Asn Gly Val Ala Glu Leu His Ser Asn
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Ile Leu Lys Glu Glu Leu Phe Ala Asp Tyr Leu Ser Ile Trp Pro Asn
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Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Leu Arg
485 490 495

Phe Cys Asn Pro Glu Leu Ser Glu Ile Val Thr Lys Trp Leu Lys Thr
500 505 510

Asp Gln Trp Thr Ser Asn Leu Asp Leu Leu Thr Gly Leu Arg Lys Phe
515 520 525

Ala Asp Asp Glu Lys Leu His Ala Glu Trp Ala Ser Ala Lys Leu Ala
530 535 540

Ser Lys Lys Arg Leu Ala Lys His Val Leu Asp Val Thr Gly Val Thr
545 550 555 560

Ile Asp Pro Asn Ser Leu Phe Asp Ile Gln Ile Lys Arg Ile His Glu
565 570 575

Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly Ala Val Tyr Arg Tyr Lys
580 585 590

Lys Leu Lys Gly Met Ser Ala Glu Glu Arg Gln Lys Val Thr Pro Arg

595 600 605

Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys
610 615 620

Arg Ile Val Lys Leu Val Asn Asp Val Gly Ala Val Val Asn Asn Asp
625 630 635 640

Pro Asp Val Asn Lys Tyr Leu Lys Val Val Phe Ile Pro Asn Tyr Asn
645 650 655

Val Ser Val Ala Glu Val Leu Ile Pro Gly Ser Glu Leu Ser Gln His
660 665 670

Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe
675 680 685

Ser Leu Asn Gly Cys Val Ile Ile Gly Thr Leu Asp Gly Ala Asn Val
690 695 700

Glu Ile Arg Glu Glu Val Gly Gln Glu Asn Phe Phe Leu Phe Gly Ala
705 710 715 720

Lys Ala Asp Gln Val Ala Gly Leu Arg Lys Asp Arg Glu Asn Gly Leu
725 730 735

Phe Lys Pro Asp Pro Arg Phe Glu Ala Lys Gln Leu Ile Arg Ser
740 745 750

Gly Ala Phe Gly Thr Tyr Asp Tyr Ala Pro Leu Leu Asp Ser Leu Glu
755 760 765

Gly Asn Ser Gly Phe Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp
770 775 780

Phe Pro Ser Tyr Ile Asp Ala Gln Ala Gln Val Asp Glu Ala Tyr Lys
785 790 795 800

Asp Lys Lys Lys Trp Ile Lys Met Ser Ile Leu Asn Thr Ala Gly Ser
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 gctacccccc ttactctca taaggattt aaaa atg ggt ttt aaa gta gaa act 175
 Met Gly Phe Lys Val Glu Thr
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aat ggt ggt gat ggt tct tta gtt tct gct aaaa gtt cca cct ctg gct 223
 Asn Gly Gly Asp Gly Ser Leu Val Ser Ala Lys Val Pro Pro Leu Ala
 10 15 20

aat cca ttg gct gaa aaaa cct gat gag att gct tct aac atc agt tat 271
 Asn Pro Leu Ala Glu Lys Pro Asp Glu Ile Ala Ser Asn Ile Ser Tyr
 25 30 35

cat gct cag tat act cct cat ttt tca cct ttc aaaa ttt cag ctt caa 319
 His Ala Gln Tyr Thr Pro His Phe Ser Pro Phe Lys Phe Gln Leu Gln
 40 45 50 55

caa gct tac tat gca act gca gag agt gtt cgt gat cgt ctc att cag 367
 Gln Ala Tyr Tyr Ala Thr Ala Glu Ser Val Arg Asp Arg Leu Ile Gln
 60 65 70

caa tgg aat gaa aca tac tta cat ttt cac aaaa gtt gat ccc aag caa 415
 Gln Trp Asn Glu Thr Tyr Leu His Phe His Lys Val Asp Pro Lys Gln
 75 80 85

aca tac tac tta tca atg gag ttc ctt caa ggt cga gct ttg acc aat 463
 Thr Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly Arg Ala Leu Thr Asn
 90 95 100

gcc att gga aat ctc aat atc caa gat gca tat gct gat gct ttg cgc 511
 Ala Ile Gly Asn Leu Asn Ile Gln Asp Ala Tyr Ala Asp Ala Leu Arg
 105 110 115

aaa ttt gga ctt gaa ctt gaa gaa ata aca gag cag gag aag gat gca 559
 Lys Phe Gly Leu Glu Leu Glu Glu Ile Thr Glu Gln Glu Lys Asp Ala
 120 125 130 135

gca cta gga aat ggt ggt ctt ggt agg ctt gct tct tgc ttt ctg gat 607
 Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu Asp
 140 145 150

tcc atg gca aca ctt aat ttg cct gct tgg ggg tac ggt ttg agg tat 655
 Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr Gly Leu Arg Tyr

155 160 165

cg^g tac gga cta ttt aag cag ata atc aca aaa gaa ggt cag gag gaa 703
Arg Tyr Gly Leu Phe Lys Gln Ile Ile Thr Lys Glu Gly Gln Glu Glu
170 175 180

gtt gct gag gac tgg ctt gag aag ttt agc cct tgg gaa att gtg agg 751
Val Ala Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp Glu Ile Val Arg
185 190 195

cat gac gtt ttg tac ccg atc aga ttc ttt ggc cag gtt gag gtt aac 799
His Asp Val Leu Tyr Pro Ile Arg Phe Phe Gly Gln Val Glu Val Asn
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cct gat gga agc cga caa tgg ata ggc gga gaa gtt att caa gca cta 847
Pro Asp Gly Ser Arg Gln Trp Ile Gly Gly Glu Val Ile Gln Ala Leu
220 225 230

gct tat gat gtg ccg att cct gga tac cag acc aag aac acc atc agt 895
Ala Tyr Asp Val Pro Ile Pro Gly Tyr Gln Thr Lys Asn Thr Ile Ser
235 240 245

ctt cgc ctc tgg gaa gcg aaa gca tgc gct gat gat ttc gat ttg ttt 943
Leu Arg Leu Trp Glu Ala Lys Ala Cys Ala Asp Asp Phe Asp Leu Phe
250 255 260

tta ttc aac gat ggg caa ctt gaa tct gct tca gtt ctt cac tca cga 991
Leu Phe Asn Asp Gly Gln Leu Glu Ser Ala Ser Val Leu His Ser Arg
265 270 275

g^cg caa cag att tgc tcg gtt ttg tat cct ggt gat gcc aca gaa ggt 1039
Ala Gln Gln Ile Cys Ser Val Leu Tyr Pro Gly Asp Ala Thr Glu Gly
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Gly Lys Leu Leu Arg Leu Lys Gln Gln Tyr Phe Leu Cys Ser Ala Ser
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Leu Gln Asp Ile Ile Ser Arg Phe Lys Glu Arg Arg Gln Gly Pro Trp
315 320 325

aac tgg tct gag ttc cca aca aag gtt gct gta caa ttg aac gat acc 1183
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330 335 340

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His Pro Thr Leu Ser Ile Pro Glu Leu Met Arg Leu Leu Met Asp Asp
345 350 355

gaa ggg ctt gga tgg gat gaa gca tgg gct gtg aca tca aag aca gtt 1279
Glu Gly Leu Gly Trp Asp Glu Ala Trp Ala Val Thr Ser Lys Thr Val
360 365 370 375

gct tac act aat cac act gtc ctc cct gaa g^cg ctg gag aaa tgg tct 1327
Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser
380 385 390

caa cct gtt atg tgg aaa ctg ctt cct cgt cac atg gaa atc ata gag 1375
Gln Pro Val Met Trp Lys Leu Leu Pro Arg His Met Glu Ile Ile Glu

395

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gaa atc gac aga cga ttc gtt gca ttg ata agt aaa acc cgt ttg gac 1423
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 410 415 420

ctt gag gac gaa gtt tcc aac atg cgc att tta gac aat aat ctt cag 1471
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 425 430 435

aaa cca gta gtt cgg atg gcg aat ttg tgt gtt tct tct cat act 1519
 Lys Pro Val Val Arg Met Ala Asn Leu Cys Val Val Ser Ser His Thr
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 Val Asn Gly Val Ala Gln Leu His Ser Asp Ile Leu Lys Ser Glu Leu
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 Phe Ala Ser Tyr Val Ser Ile Trp Pro Thr Lys Phe Gln Asn Lys Thr
 475 480 485

aat ggc att acg cct cga aga tgg atc aat ttc tgc agt cct gag cta 1663
 Asn Gly Ile Thr Pro Arg Arg Trp Ile Asn Phe Cys Ser Pro Glu Leu
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agc agg ata atc aca aag tgg tta aaa act gat aaa tgg gta acc aat 1711
 Ser Arg Ile Ile Thr Lys Trp Leu Lys Thr Asp Lys Trp Val Thr Asn
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ctt gac cta tta aca ggt ctt cgt gag ttt gct gac aac gaa gat cta 1759
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 520 525 530 535

caa gca gag tgg ctg tct gca aag agg gct aat aag cag cgc tta gca 1807
 Gln Ala Glu Trp Leu Ser Ala Lys Arg Ala Asn Lys Gln Arg Leu Ala
 540 545 550

cag tat gtt ctg caa gtg aca ggg gag aac att gac cct gat agt cta 1855
 Gln Tyr Val Leu Gln Val Thr Gly Glu Asn Ile Asp Pro Asp Ser Leu
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 Phe Asp Ile Gln Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Leu
 570 575 580

aac att ctt ggt gtg atc tat aga tat aaa aag tta aag gag atg agc 1951
 Asn Ile Leu Gly Val Ile Tyr Arg Tyr Lys Lys Leu Lys Glu Met Ser
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cct gaa gaa cgg aaa agt aca act gca cgc acg gtc atg att gga gga 1999
 Pro Glu Glu Arg Lys Ser Thr Thr Ala Arg Thr Val Met Ile Gly Gly
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aag gca ttt gca acg tac aca aat gct aaa cgg ata gtc aag ctt gtc 2047
 Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys Arg Ile Val Lys Leu Val
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gat gat gtt ggt tct gtt gta aac agt gat cct gaa gtc aat agc tac 2095
 Asp Asp Val Gly Ser Val Val Asn Ser Asp Pro Glu Val Asn Ser Tyr

635

640

645

ttg aag gtt gtg ttt gtg cca aat tac aac gta tca gtg gcg gag gtg 2143
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 650 655 660

ctt atc cca ggg agc gag cta tcg cag cat atc agc act gca gga atg 2191
 Leu Ile Pro Gly Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly Met
 665 670 675

gaa gca agt ggc acg agc aac atg aaa ttt gct ttg aac cgg gtg ctt 2239
 Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Leu Asn Arg Val Leu
 680 685 690 695

ata ata ggt aca tta gat gga gct aat gtc gaa atc cgg gag gag att 2287
 Ile Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu Glu Ile
 700 705 710

ggt gag gag aat ttt ttc ctg ttt ggt gca aca gcg gat gaa gtc cct 2335
 Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Thr Ala Asp Glu Val Pro
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cga ctc agg aag gaa aga gag aat gga ctg ttc aag ccg gat cct cga 2383
 Arg Leu Arg Lys Glu Arg Glu Asn Gly Leu Phe Lys Pro Asp Pro Arg
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ttc gaa gag gca aag aag ttt ata agg agt ggg gtg ttt gga agc tac 2431
 Phe Glu Glu Ala Lys Lys Phe Ile Arg Ser Gly Val Phe Gly Ser Tyr
 745 750 755

gac tac aac cca ttg ctc gat tca ttg gaa gga aat tct ggt tat ggt 2479
 Asp Tyr Asn Pro Leu Leu Asp Ser Leu Glu Gly Asn Ser Gly Tyr Gly
 760 765 770 775

cgc gga gat tac ttt ctt gtt ggt tat gac ttc cca agc tac atg gat 2527
 Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp Phe Pro Ser Tyr Met Asp
 780 785 790

gct cag gaa aaa gta gac gaa gca tat cgt gat aag aaa agg tgg cta 2575
 Ala Gln Glu Lys Val Asp Glu Ala Tyr Arg Asp Lys Lys Arg Trp Leu
 795 800 805

aaa atg tct att tta agc act gct ggg agt ggg aag ttc agc agt gac 2623
 Lys Met Ser Ile Leu Ser Thr Ala Gly Ser Gly Lys Phe Ser Ser Asp
 810 815 820

agg aca att gct cag tat gct aag gaa att tgg aac atc gaa gaa tgc 2671
 Arg Thr Ile Ala Gln Tyr Ala Lys Glu Ile Trp Asn Ile Glu Glu Cys
 825 830 835

cgg gta cca taa ttcaaggct ctgtatagta ctagaggatt gaaattaatg 2723
 Arg Val Pro
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acagtatata gtcataata aaaaagaaca taatttcta tatttgattt tagtatgcc 2783

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35 40 45

Pro Phe Lys Phe Gln Leu Gln Gln Ala Tyr Tyr Ala Thr Ala Glu Ser
50 55 60

Val Arg Asp Arg Leu Ile Gln Gln Trp Asn Glu Thr Tyr Leu His Phe
65 70 75 80

His Lys Val Asp Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Phe Leu
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Gln Gly Arg Ala Leu Thr Asn Ala Ile Gly Asn Leu Asn Ile Gln Asp
100 105 110

Ala Tyr Ala Asp Ala Leu Arg Lys Phe Gly Leu Glu Leu Glu Ile
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Thr Glu Gln Glu Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg
130 135 140

Leu Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala
145 150 155 160

Trp Gly Tyr Gly Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Ile Ile
165 170 175

Thr Lys Glu Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Lys Phe
180 185 190

Ser Pro Trp Glu Ile Val Arg His Asp Val Leu Tyr Pro Ile Arg Phe
195 200 205

Phe Gly Gln Val Glu Val Asn Pro Asp Gly Ser Arg Gln Trp Ile Gly
210 215 220

Gly Glu Val Ile Gln Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr
225 230 235 240

Gln Thr Lys Asn Thr Ile Ser Leu Arg Leu Trp Glu Ala Lys Ala Cys
245 250 255

Ala Asp Asp Phe Asp Leu Phe Leu Phe Asn Asp Gly Gln Leu Glu Ser
260 265 270

Ala Ser Val Leu His Ser Arg Ala Gln Gln Ile Cys Ser Val Leu Tyr
275 280 285

Pro Gly Asp Ala Thr Glu Gly Gly Lys Leu Leu Arg Leu Lys Gln Gln
290 295 300

Tyr Phe Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Ser Arg Phe Lys
305 310 315 320

Glu Arg Arg Gln Gly Pro Trp Asn Trp Ser Glu Phe Pro Thr Lys Val
325 330 335

Ala Val Gln Leu Asn Asp Thr His Pro Thr Leu Ser Ile Pro Glu Leu
340 345 350

Met Arg Leu Leu Met Asp Asp Glu Gly Leu Gly Trp Asp Glu Ala Trp
355 360 365

Ala Val Thr Ser Lys Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro
370 375 380

Glu Ala Leu Glu Lys Trp Ser Gln Pro Val Met Trp Lys Leu Leu Pro
385 390 395 400

Arg His Met Glu Ile Ile Glu Glu Ile Asp Arg Arg Phe Val Ala Leu
405 410 415

Ile Ser Lys Thr Arg Leu Asp Leu Glu Asp Glu Val Ser Asn Met Arg
420 425 430

Ile Leu Asp Asn Asn Leu Gln Lys Pro Val Val Arg Met Ala Asn Leu
435 440 445

Cys Val Val Ser Ser His Thr Val Asn Gly Val Ala Gln Leu His Ser
450 455 460

Asp Ile Leu Lys Ser Glu Leu Phe Ala Ser Tyr Val Ser Ile Trp Pro
465 470 475 480

Thr Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Ile
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Asn Phe Cys Ser Pro Glu Leu Ser Arg Ile Ile Thr Lys Trp Leu Lys
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Thr Asp Lys Trp Val Thr Asn Leu Asp Leu Leu Thr Gly Leu Arg Glu
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Phe Ala Asp Asn Glu Asp Leu Gln Ala Glu Trp Leu Ser Ala Lys Arg
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Ala Asn Lys Gln Arg Leu Ala Gln Tyr Val Leu Gln Val Thr Gly Glu
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Asn Ile Asp Pro Asp Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His
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Glu Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly Val Ile Tyr Arg Tyr
580 585 590

Lys Lys Leu Lys Glu Met Ser Pro Glu Glu Arg Lys Ser Thr Thr Ala
595 600 605

Arg Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala
610 615 620

Lys Arg Ile Val Lys Leu Val Asp Asp Val Gly Ser Val Val Asn Ser
625 630 635 640

Asp Pro Glu Val Asn Ser Tyr Leu Lys Val Val Phe Val Pro Asn Tyr
645 650 655

Asn Val Ser Val Ala Glu Val Leu Ile Pro Gly Ser Glu Leu Ser Gln
660 665 670

His Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys
675 680 685

Phe Ala Leu Asn Arg Val Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn
690 695 700

Val Glu Ile Arg Glu Glu Ile Gly Glu Glu Asn Phe Phe Leu Phe Gly
705 710 715 720

Ala Thr Ala Asp Glu Val Pro Arg Leu Arg Lys Glu Arg Glu Asn Gly
725 730 735

Leu Phe Lys Pro Asp Pro Arg Phe Glu Glu Ala Lys Lys Phe Ile Arg
740 745 750

Ser Gly Val Phe Gly Ser Tyr Asp Tyr Asn Pro Leu Leu Asp Ser Leu
755 760 765

Glu Gly Asn Ser Gly Tyr Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr
770 775 780

Asp Phe Pro Ser Tyr Met Asp Ala Gln Glu Lys Val Asp Glu Ala Tyr
785 790 795 800

Arg Asp Lys Lys Arg Trp Leu Lys Met Ser Ile Leu Ser Thr Ala Gly
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Ser Gly Lys Phe Ser Ser Asp Arg Thr Ile Ala Gln Tyr Ala Lys Glu
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tcg gct aag gcg aat ccg gag gcc gat gat gct acg gag atc gct ggg 96
Ser Ala Lys Ala Asn Pro Glu Ala Asp Asp Ala Thr Glu Ile Ala Gly
20 25 30

aat atc gtc tac cac gcc aag tac agt cca cat ttc tct cca ttg aag 144
Asn Ile Val Tyr His Ala Lys Tyr Ser Pro His Phe Ser Pro Leu Lys
35 40 45

ttc ggg cct gag caa gct ctc tac gct acc gca gag agt ctt cgc gat 192
Phe Gly Pro Glu Gln Ala Leu Tyr Ala Thr Ala Glu Ser Leu Arg Asp
50 55 60

cgt ctc att cag ctg tgg aat gag act tat gtt cat ttt aac aaa gtt 240
Arg Leu Ile Gln Leu Trp Asn Glu Thr Tyr Val His Phe Asn Lys Val
65 70 75 80

gat cca aaa caa act tat tac ttg tca atg gag tat ctc caa ggt cgt 288
Asp Pro Lys Gln Thr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg
85 90 95

gct ttg acc aat gcc att ggg aat ttg aac ctt caa ggt cca tat gct 336
Ala Leu Thr Asn Ala Ile Gly Asn Leu Asn Leu Gln Gly Pro Tyr Ala
100 105 110

gat gca ctg cgt acg ctg ggt tat gag ctt gag gag ata gct gag cag 384
Asp Ala Leu Arg Thr Leu Gly Tyr Glu Leu Glu Glu Ile Ala Glu Gln
115 120 125

gag aaa gat gca gct cta gga aat ggt ggg tta ggg aga ctt gcc tcg 432
Glu Lys Asp Ala Ala Leu Gly Asn Gly Leu Gly Arg Leu Ala Ser
130 135 140

tgt ttc ttg gat tcg atg gcc acc cta aat ctg cct gct tgg ggt tat 480
Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr
145 150 155 160

ggt ttg agg tac aga cat ggg ttg ttt aag caa ata atc aca aag aaa 528
Gly Leu Arg Tyr Arg His Gly Leu Phe Lys Gln Ile Ile Thr Lys Lys
165 170 175

ggt caa gaa gag att cca gag gac tgg ctt gag aaa ttc agc cca tgg 576
Gly Gln Glu Glu Ile Pro Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp
180 185 190

gaa att gtg agg cac gac gtg gta ttc cct gtc aga ttt ttc ggc aag 624
Glu Ile Val Arg His Asp Val Val Phe Pro Val Arg Phe Phe Gly Lys
195 200 205

gtg caa gta aat ccg gat gga tca agg aaa tgg gta gat ggt gat gtt 672
Val Gln Val Asn Pro Asp Gly Ser Arg Lys Trp Val Asp Gly Asp Val
210 215 220

gta caa gct ctt gct tat gac gtg cca atc ccg gga tat ggc aca aag 720
Val Gln Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Gly Thr Lys
225 230 235 240

aac aca atc agt ctc cgt ctc tgg gaa gca aaa gct aga gct gag gat 768
Asn Thr Ile Ser Leu Arg Leu Trp Glu Ala Lys Ala Arg Ala Glu Asp
245 250 255

ctt gat ctt ttt cag ttc aac gaa gga gaa tat gaa ttg gct gca cag 816
Leu Asp Leu Phe Gln Phe Asn Glu Gly Glu Tyr Glu Leu Ala Ala Gln
260 265 270

ctt cat tct cga gct caa cag att tgc act gtt tta tat cca gga gat 864
Leu His Ser Arg Ala Gln Gln Ile Cys Thr Val Leu Tyr Pro Gly Asp
275 280 285

gct acc gag aat ggg aag tta tta cgg tta aaa cag cag ttc ttt ctc 912
Ala Thr Glu Asn Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe Phe Leu
290 295 300

tgc agt gct tcg ctt cag gat att ata tca aga ttt cac gag agg agc 960
Cys Ser Ala Ser Leu Gln Asp Ile Ile Ser Arg Phe His Glu Arg Ser
305 310 315 320

acc act gaa ggc agc cgg aaa tgg tca gag ttt cca agt aaa gtt gct 1008
Thr Thr Glu Gly Ser Arg Lys Trp Ser Glu Phe Pro Ser Lys Val Ala
325 330 335

gtt caa atg aat gac aca cac cca act ctt gca ata cct gag ctc atg 1056
Val Gln Met Asn Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met
340 345 350

cga ttg cta atg gat gac aat gga ctt gga tgg gat gag gct tgg gat 1104
Arg Leu Leu Met Asp Asp Asn Gly Leu Gly Trp Asp Glu Ala Trp Asp
355 360 365

gtg aca tca aag acc gtt gct tac acc aat cac act gtc ctt cct gaa 1152
Val Thr Ser Lys Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu
370 375 380

gcg ttg gag aaa tgg tca caa tct ttg atg tgg aag ctt ctt cct cgt 1200
Ala Leu Glu Lys Trp Ser Gln Ser Leu Met Trp Lys Leu Leu Pro Arg
385 390 395 400

cat atg gaa ata ata gaa gag att gac aag agg ttt gtt caa acc att 1248
His Met Glu Ile Ile Glu Glu Ile Asp Lys Arg Phe Val Gln Thr Ile
405 410 415

cgc gat aca aga gtt gat ctg gag gat aag att tca agt ttg agc atc 1296
Arg Asp Thr Arg Val Asp Leu Glu Asp Lys Ile Ser Ser Leu Ser Ile
420 425 430

tta gat aac aat cca caa aag cct gtg gtg aga atg gct aac tta tgt 1344
Leu Asp Asn Asn Pro Gln Lys Pro Val Val Arg Met Ala Asn Leu Cys
435 440 445

gtt gta tcc tcg cat acg gtg aat ggc gtt gct cag tta cac agt gat 1392
Val Val Ser Ser His Thr Val Asn Gly Val Ala Gln Leu His Ser Asp
450 455 460

atc ttg aag gct gag tta ttc gca gac tat gtc tct ata tgg cca aac 1440
Ile Leu Lys Ala Glu Leu Phe Ala Asp Tyr Val Ser Ile Trp Pro Asn
465 470 475 480

aag ttt caa aac aag act aat ggc atc aca cct cga agg tgg tta cgt 1488
Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Leu Arg
485 490 495

ttc tgc agc cct gag ctc agt gat ata atc aca aag tgg tta aag act 1536
Phe Cys Ser Pro Glu Leu Ser Asp Ile Ile Thr Lys Trp Leu Lys Thr
500 505 510

gac aaa tgg att acc gat ctt gac cta ctt acc ggt ctt.cgc cag ttt 1584
Asp Lys Trp Ile Thr Asp Leu Asp Leu Leu Thr Gly Leu Arg Gln Phe
515 520 525

gcg gac aat gaa gaa ctc caa tct gaa tgg gct tct gca aag aca gcc 1632
Ala Asp Asn Glu Glu Leu Gln Ser Glu Trp Ala Ser Ala Lys Thr Ala
530 535 540

aat aag aaa cgt ttg gct caa tat ata gag cgt gtg act ggt gtg agt 1680
Asn Lys Lys Arg Leu Ala Gln Tyr Ile Glu Arg Val Thr Gly Val Ser
545 550 555 560

atc gat cca aca aac tta ttt gac ata caa gtt aag cgt atc cac gaa 1728
Ile Asp Pro Thr Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His Glu
565 570 575

tac aag agg cag ctg atg aac att ctt gga gta gta tac aga ttc aag 1776
Tyr Lys Arg Gln Leu Met Asn Ile Leu Gly Val Val Tyr Arg Phe Lys
580 585 590

aaa cta aag gag atg aag cct gag gag agg aag aaa aca gtt cct cgt 1824
Lys Leu Lys Glu Met Lys Pro Glu Glu Arg Lys Lys Thr Val Pro Arg
595 600 605

act gtc atg att ggg ggt aaa gca ttt gcc acc tat aca aat gca aaa 1872
Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys
610 615 620

cgg ata gtg aag ctg gtg aat gat gtt ggt gat gtt gtt aac agc gat 1920
Arg Ile Val Lys Leu Val Asn Asp Val Gly Asp Val Val Asn Ser Asp
625 630 635 640

cca gag gtc aac gaa tac cta aag gtg gta ttt gtt cca aac tac aat 1968
Pro Glu Val Asn Glu Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn
645 650 655

gtc act gta gcg gag atg cta ata ccc gga agt gag cta tct caa cac 2016
Val Thr Val Ala Glu Met Leu Ile Pro Gly Ser Glu Leu Ser Gln His
660 665 670

atc agc aca gca ggc atg gag gca agt ggt acc agc aat atg aaa ttc 2064
Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe
675 680 685

gct ctc aac ggt tgt ctt att ata gga acc ctt gat ggg gct aat gtt 2112
Ala Leu Asn Gly Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val
690 695 700

gag ata aga gag gag gtt ggc gaa gaa aat ttc ttt ctt ttt ggt gca 2160
Glu Ile Arg Glu Glu Val Gly Glu Asn Phe Phe Leu Phe Gly Ala
705 710 715 720

acg gcc gat cag gtc cct cga ctg cgt aaa gaa cga gaa gac gga ctg 2208
Thr Ala Asp Gln Val Pro Arg Leu Arg Lys Glu Arg Glu Asp Gly Leu
725 730 735

ttc aaa ccc gat cct cgg ttc gaa gag gca aag cag ttt gtc aaa agt 2256
Phe Lys Pro Asp Pro Arg Phe Glu Glu Ala Lys Gln Phe Val Lys Ser
740 745 750

gga gtg ttt ggg agc tac gat tat ggt cca ctc ctt gat tct ctt gag 2304
Gly Val Phe Gly Ser Tyr Asp Tyr Gly Pro Leu Leu Asp Ser Leu Glu
755 760 765

ggt aac aca ggt ttt gga cgt ggt gat tac ttc ctg gtt ggg tat gac 2352
Gly Asn Thr Gly Phe Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp
770 775 780

ttc ccc agc tac atg gac gct cag gcc aaa gtt gac gaa gct tat aag 2400
Phe Pro Ser Tyr Met Asp Ala Gln Ala Lys Val Asp Glu Ala Tyr Lys
785 790 795 800

gac cgg aag ggg tgg ctg aaa atg tcg ata ttg agc aca gcc ggg tca 2448
Asp Arg Lys Gly Trp Leu Lys Met Ser Ile Leu Ser Thr Ala Gly Ser
805 810 815

gga aag ttc agc agt gac cgt aca ata gct cag tat gcc aaa gag att 2496
Gly Lys Phe Ser Ser Asp Arg Thr Ile Ala Gln Tyr Ala Lys Glu Ile
820 825 830

tgg aac att gag gct tgt cct gtt ccc taa 2526
Trp Asn Ile Glu Ala Cys Pro Val Pro
835 840

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Asn Ile Val Tyr His Ala Lys Tyr Ser Pro His Phe Ser Pro Leu Lys
35 40 45

Phe Gly Pro Glu Gln Ala Leu Tyr Ala Thr Ala Glu Ser Leu Arg Asp
50 55 60

Arg Leu Ile Gln Leu Trp Asn Glu Thr Tyr Val His Phe Asn Lys Val
65 70 75 80

Asp Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg
85 90 95

Ala Leu Thr Asn Ala Ile Gly Asn Leu Asn Leu Gln Gly Pro Tyr Ala
100 105 110

Asp Ala Leu Arg Thr Leu Gly Tyr Glu Leu Glu Glu Ile Ala Glu Gln
115 120 125

Glu Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser
130 135 140

Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr
145 150 155 160

Gly Leu Arg Tyr Arg His Gly Leu Phe Lys Gln Ile Ile Thr Lys Lys
165 170 175

Gly Gln Glu Glu Ile Pro Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp
180 185 190

Glu Ile Val Arg His Asp Val Val Phe Pro Val Arg Phe Phe Gly Lys
195 200 205

Val Gln Val Asn Pro Asp Gly Ser Arg Lys Trp Val Asp Gly Asp Val
210 215 220

Val Gln Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Gly Thr Lys
225 230 235 240

Asn Thr Ile Ser Leu Arg Leu Trp Glu Ala Lys Ala Arg Ala Glu Asp
245 250 255

Leu Asp Leu Phe Gln Phe Asn Glu Gly Glu Tyr Glu Leu Ala Ala Gln
260 265 270

Leu His Ser Arg Ala Gln Gln Ile Cys Thr Val Leu Tyr Pro Gly Asp
275 280 285

Ala Thr Glu Asn Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe Phe Leu
290 295 300

Cys Ser Ala Ser Leu Gln Asp Ile Ile Ser Arg Phe His Glu Arg Ser
305 310 315 320

Thr Thr Glu Gly Ser Arg Lys Trp Ser Glu Phe Pro Ser Lys Val Ala
325 330 335

Val Gln Met Asn Asp Thr His Pro Thr Leu Ala Ile Pro Glu Leu Met
340 345 350

Lys Leu Lys Glu Met Lys Pro Glu Glu Arg Lys Lys Thr Val Pro Arg
595 600 605

Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys
610 615 620

Arg Ile Val Lys Leu Val Asn Asp Val Gly Asp Val Val Asn Ser Asp
625 630 635 640

Pro Glu Val Asn Glu Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn
645 650 655

Val Thr Val Ala Glu Met Leu Ile Pro Gly Ser Glu Leu Ser Gln His
660 665 670

Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe
675 680 685

Ala Leu Asn Gly Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val
690 695 700

Glu Ile Arg Glu Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala
705 710 715 720

Thr Ala Asp Gln Val Pro Arg Leu Arg Lys Glu Arg Glu Asp Gly Leu
725 730 735

Phe Lys Pro Asp Pro Arg Phe Glu Glu Ala Lys Gln Phe Val Lys Ser
740 745 750

Gly Val Phe Gly Ser Tyr Asp Tyr Gly Pro Leu Leu Asp Ser Leu Glu
755 760 765

Gly Asn Thr Gly Phe Gly Arg Gly Asp Tyr Phe Leu Val Gly Tyr Asp
770 775 780

Phe Pro Ser Tyr Met Asp Ala Gln Ala Lys Val Asp Glu Ala Tyr Lys
785 790 795 800

Asp Arg Lys Gly Trp Leu Lys Met Ser Ile Leu Ser Thr Ala Gly Ser
805 810 815

Gly Lys Phe Ser Ser Asp Arg Thr Ile Ala Gln Tyr Ala Lys Glu Ile
820 825 830

Trp Asn Ile Glu Ala Cys Pro Val Pro
835 840

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Pro Ile Ala Gln Pro Leu Ser Glu Asp Pro Thr Asp Ile Ala Ser Asn
15 20 25

atc aag tat cat gct caa tat act cct cat ttt tct cct ttc aag ttt 146
Ile Lys Tyr His Ala Gln Tyr Thr Pro His Phe Ser Pro Phe Lys Phe
30 35 40 45

gag cca cta caa gca tac tat gct gct act gac agt gtt cgt gat 194
Glu Pro Leu Gln Ala Tyr Tyr Ala Ala Thr Ala Asp Ser Val Arg Asp
50 55 60

cgc ttg atc aaa caa tgg aat gac acc tat ctt cat tat gac aaa gtt 242
Arg Leu Ile Lys Gln Trp Asn Asp Thr Tyr Leu His Tyr Asp Lys Val
65 70 75

aat cca aag caa aca tac tac tta tca atg gag tat ctc cag ggg cga 290
Asn Pro Lys Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg
80 85 90

gct ttg aca aat gca gtt gga aac tta gac atc cac aat gca tat gct 338
Ala Leu Thr Asn Ala Val Gly Asn Leu Asp Ile His Asn Ala Tyr Ala
95 100 105

gat gct tta aac aaa ctg ggt cag cag ctt gag gag gtc gtt gag cag 386
Asp Ala Leu Asn Lys Leu Gly Gln Gln Leu Glu Glu Val Val Glu Gln
110 115 120 125

gaa aaa gat gca gca tta gga aat ggt ggt tta gga agg ctc gct tca 434
Glu Lys Asp Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser
130 135 140

tgc ttt ctt gat tcc atg gcc aca ttg aac ctt cca gca tgg ggt tat 482
Cys Phe Leu Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr
145 150 155

ggc ttg agg tac aga tat gga ctt ttt aag cag ctt atc aca aag gct 530
Gly Leu Arg Tyr Arg Tyr Gly Leu Phe Lys Gln Leu Ile Thr Lys Ala
160 165 170

ggg caa gaa gaa gtt cct gaa gat tgg ttg gag aaa ttt agt ccc tgg 578
 Gly Gln Glu Glu Val Pro Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp
 175 180 185

gaa att gta agg cat gat gtt gtc ttt cct atc agg ttt ttt ggt cat 626
 Glu Ile Val Arg His Asp Val Val Phe Pro Ile Arg Phe Phe Gly His
 190 195 200 205

gtt gaa gtc ctc cct tct ggc tcg cga aaa tgg gtt ggt gga gag gtc 674
 Val Glu Val Leu Pro Ser Gly Ser Arg Lys Trp Val Gly Gly Glu Val
 210 215 220

cta cag gct ctt gca tat gat gtg cca att cca gga tac aga act aaa 722
 Leu Gln Ala Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Arg Thr Lys
 225 230 235

aac act aat agt ctt cgt ctc tgg gaa gcc aaa gca agc tct gag gat 770
 Asn Thr Asn Ser Leu Arg Leu Trp Glu Ala Lys Ala Ser Ser Glu Asp
 240 245 250

ttc aac ttg ttt ctg ttt aat gat gga cag tat gat gct gca cag 818
 Phe Asn Leu Phe Leu Phe Asn Asp Gly Gln Tyr Asp Ala Ala Ala Gln
 255 260 265

ctt cat tct agg gct cag cag att tgt gct gtt ctc tac cct ggg gat 866
 Leu His Ser Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro Gly Asp
 270 275 280 285

gct aca gag aat gga aaa ctc tta cgg cta aag caa caa ttt ttt ctg 914
 Ala Thr Glu Asn Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe Phe Leu
 290 295 300

tgc agt gca tcg ctt cag gat att att gcc aga ttc aaa gag aga gaa 962
 Cys Ser Ala Ser Leu Gln Asp Ile Ile Ala Arg Phe Lys Glu Arg Glu
 305 310 315

gat gga aag ggt tct cac cag tgg tct gaa ttc ccc aag aag gtt gcg 1010
 Asp Gly Lys Gly Ser His Gln Trp Ser Glu Phe Pro Lys Lys Val Ala
 320 325 330

ata caa cta aat gac aca cat cca act ctt acg att cca gag ctg atg 1058
 Ile Gln Leu Asn Asp Thr His Pro Thr Leu Thr Ile Pro Glu Leu Met
 335 340 345

cgg ttg cta atg gat gat gaa gga ctt ggg tgg gat gaa tct tgg aat 1106
 Arg Leu Leu Met Asp Asp Glu Gly Leu Gly Trp Asp Glu Ser Trp Asn
 350 355 360 365

atc act act agg aca att gcc tat acg aat cat aca gtc cta cct gaa 1154
 Ile Thr Thr Arg Thr Ile Ala Tyr Thr Asn His Thr Val Leu Pro Glu
 370 375 380

gca ctt gaa aaa tgg tct cag gca gtc atg tgg aag ctc ctt cct aga 1202
 Ala Leu Glu Lys Trp Ser Gln Ala Val Met Trp Lys Leu Leu Pro Arg
 385 390 395

cat atg gaa atc att gaa gaa att gac aaa cgg ttt gtt gct aca ata 1250
 His Met Glu Ile Ile Glu Glu Ile Asp Lys Arg Phe Val Ala Thr Ile
 400 405 410

atg tca gaa aga cct gat ctt gag aat aag atg cct agc atg cgc att 1298
Met Ser Glu Arg Pro Asp Leu Glu Asn Lys Met Pro Ser Met Arg Ile
415 420 425

ttg gat cac aac gcc aca aaa cct gtt gtg cat atg gct aac ttg tgt 1346
Leu Asp His Asn Ala Thr Lys Pro Val Val His Met Ala Asn Leu Cys
430 435 440 445

gtt gtc tct tca cat acg gta aat ggt gtt gcc cag ctg cat agt gac 1394
Val Val Ser Ser His Thr Val Asn Gly Val Ala Gln Leu His Ser Asp
450 455 460

atc ctg aag gct gag tta ttt gct gat tat gtc tct gta tgg ccc acc 1442
Ile Leu Lys Ala Glu Leu Phe Ala Asp Tyr Val Ser Val Trp Pro Thr
465 470 475

aag ttc cag aat aag acc aat ggt ata act cct cgt agg tgg atc cga 1490
Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Ile Arg
480 485 490

ttt tgt agt cct gag ctg agt cat ata att acc aag tgg tta aaa aca 1538
Phe Cys Ser Pro Glu Leu Ser His Ile Ile Thr Lys Trp Leu Lys Thr
495 500 505

gat caa tgg gtg acg aac ctc gaa ctg ctt gct aat ctt cgg gag ttt 1586
Asp Gln Trp Val Thr Asn Leu Glu Leu Leu Ala Asn Leu Arg Glu Phe
510 515 520 525

gct gat aat tcg gag ctc cat gct gaa tgg gaa tca gcc aag atg gcc 1634
Ala Asp Asn Ser Glu Leu His Ala Glu Trp Glu Ser Ala Lys Met Ala
530 535 540

aac aag cag cgt ttg gca cag tat ata ctg cat gtg aca ggt gtg agc 1682
Asn Lys Gln Arg Leu Ala Gln Tyr Ile Leu His Val Thr Gly Val Ser
545 550 555

atc gat cca aat tcc ctt ttt gac ata caa gtc aaa cgt atc cat gaa 1730
Ile Asp Pro Asn Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His Glu
560 565 570

tac aaa agg cag ctt cta aat att ctg ggc gtc atc tat aga tac aag 1778
Tyr Lys Arg Gln Leu Leu Asn Ile Leu Gly Val Ile Tyr Arg Tyr Lys
575 580 585

aag ctt aag gga atg agc cct gaa gaa agg aaa aat aca act cct cgc 1826
Lys Leu Lys Gly Met Ser Pro Glu Glu Arg Lys Asn Thr Thr Pro Arg
590 595 600 605

aca gtc atg att gga gga aaa gca ttt gca aca tac aca aat gca aaa 1874
Thr Val Met Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys
610 615 620

cga att gtc aag ctc gtg act gat gtt ggc gac gtt gtc aat agt gac 1922
Arg Ile Val Lys Leu Val Thr Asp Val Gly Asp Val Val Asn Ser Asp
625 630 635

cct gac gtc aat gac tat ttg aag gtg gtt ttt gtt ccc aac tac aat 1970
Pro Asp Val Asn Asp Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn
640 645 650

gta tct gtg gca gag atg ctt att ccg gga agt gag cta tca caa cac 2018
Val Ser Val Ala Glu Met Leu Ile Pro Gly Ser Glu Leu Ser Gln His
655 660 665

atc agt act gca ggc atg gaa gca agt gga aca aac atg aaa ttt 2066
Ile Ser Thr Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe
670 675 680 685

gcc ctt aat gga tgc ctt atc att ggg aca cta gat ggg gcc aat gtg 2114
Ala Leu Asn Gly Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val
690 695 700

gaa att agg gag gaa att gga gaa gat aac ttc ttt ctt ttt ggt gca 2162
Glu Ile Arg Glu Glu Ile Gly Glu Asp Asn Phe Phe Leu Phe Gly Ala
705 710 715

aca gct gat gaa gtt cct caa ctg cgc aaa gat cga gag aat gga ctg 2210
Thr Ala Asp Glu Val Pro Gln Leu Arg Lys Asp Arg Glu Asn Gly Leu
720 725 730

ttc aaa cct gat cct cgg ttt gaa gag gca aaa caa ttt att agg tct 2258
Phe Lys Pro Asp Pro Arg Phe Glu Glu Ala Lys Gln Phe Ile Arg Ser
735 740 745

gga gca ttt ggg acg tat gat tat aat ccc ctc ctt gaa tca ctg gaa 2306
Gly Ala Phe Gly Thr Tyr Asp Tyr Asn Pro Leu Leu Glu Ser Leu Glu
750 755 760 765

ggg aac tcg gga tat ggt cgt gga gac tat ttt ctt gtt ggt cat gat 2354
Gly Asn Ser Gly Tyr Gly Arg Gly Asp Tyr Phe Leu Val Gly His Asp
770 775 780

ttt ccg agc tac atg gat gct cag gca agg gtt gat gaa gct tac aag 2402
Phe Pro Ser Tyr Met Asp Ala Gln Ala Arg Val Asp Glu Ala Tyr Lys
785 790 795

gac agg aaa aga tgg ata aag atg tct ata ctg agc act agt ggg agt 2450
Asp Arg Lys Arg Trp Ile Lys Met Ser Ile Leu Ser Thr Ser Gly Ser
800 805 810

ggc aaa ttt agt agt gac cgt aca att tct caa tat gca aaa gag atc 2498
Gly Lys Phe Ser Ser Asp Arg Thr Ile Ser Gln Tyr Ala Lys Glu Ile
815 820 825

tgg aac att gcc gag tgt cgc gtg cct tga gcacacttct gaacctggta 2548
Trp Asn Ile Ala Glu Cys Arg Val Pro
830 835

tctaataagg atctaatgtt cattgtttac tagcatatga ataatgtaa ttcaagcaca 2608
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His Ala Gln Tyr Thr Pro His Phe Ser Pro Phe Lys Phe Glu Pro Leu
35 40 45

Gln Ala Tyr Tyr Ala Ala Thr Ala Asp Ser Val Arg Asp Arg Leu Ile
50 55 60

Lys Gln Trp Asn Asp Thr Tyr Leu His Tyr Asp Lys Val Asn Pro Lys
65 70 75 80

Gln Thr Tyr Tyr Leu Ser Met Glu Tyr Leu Gln Gly Arg Ala Leu Thr
85 90 95

Asn Ala Val Gly Asn Leu Asp Ile His Asn Ala Tyr Ala Asp Ala Leu
100 105 110

Asn Lys Leu Gly Gln Gln Leu Glu Glu Val Val Glu Gln Glu Lys Asp
115 120 125

Ala Ala Leu Gly Asn Gly Gly Leu Gly Arg Leu Ala Ser Cys Phe Leu
130 135 140

Asp Ser Met Ala Thr Leu Asn Leu Pro Ala Trp Gly Tyr Gly Leu Arg
145 150 155 160

Tyr Arg Tyr Gly Leu Phe Lys Gln Leu Ile Thr Lys Ala Gly Gln Glu
165 170 175

Glu Val Pro Glu Asp Trp Leu Glu Lys Phe Ser Pro Trp Glu Ile Val
180 185 190

Arg His Asp Val Val Phe Pro Ile Arg Phe Phe Gly His Val Glu Val
195 200 205

Leu Pro Ser Gly Ser Arg Lys Trp Val Gly Glu Val Leu Gln Ala
210 215 220

Leu Ala Tyr Asp Val Pro Ile Pro Gly Tyr Arg Thr Lys Asn Thr Asn
225 230 235 240

Ser Leu Arg Leu Trp Glu Ala Lys Ala Ser Ser Glu Asp Phe Asn Leu
245 250 255

Phe Leu Phe Asn Asp Gly Gln Tyr Asp Ala Ala Ala Gln Leu His Ser
260 265 270

Arg Ala Gln Gln Ile Cys Ala Val Leu Tyr Pro Gly Asp Ala Thr Glu
275 280 285

Asn Gly Lys Leu Leu Arg Leu Lys Gln Gln Phe Phe Leu Cys Ser Ala
290 295 300

Ser Leu Gln Asp Ile Ile Ala Arg Phe Lys Glu Arg Glu Asp Gly Lys
305 310 315 320

Gly Ser His Gln Trp Ser Glu Phe Pro Lys Lys Val Ala Ile Gln Leu
325 330 335

Asn Asp Thr His Pro Thr Leu Thr Ile Pro Glu Leu Met Arg Leu Leu
340 345 350

Met Asp Asp Glu Gly Leu Gly Trp Asp Glu Ser Trp Asn Ile Thr Thr
355 360 365

Arg Thr Ile Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu Glu
370 375 380

Lys Trp Ser Gln Ala Val Met Trp Lys Leu Leu Pro Arg His Met Glu
385 390 395 400

Ile Ile Glu Glu Ile Asp Lys Arg Phe Val Ala Thr Ile Met Ser Glu
405 410 415

Arg Pro Asp Leu Glu Asn Lys Met Pro Ser Met Arg Ile Leu Asp His
420 425 430

Asn Ala Thr Lys Pro Val Val His Met Ala Asn Leu Cys Val Val Ser
435 440 445

Ser His Thr Val Asn Gly Val Ala Gln Leu His Ser Asp Ile Leu Lys
450 455 460

Ala Glu Leu Phe Ala Asp Tyr Val Ser Val Trp Pro Thr Lys Phe Gln
465 470 475 480

Asn Lys Thr Asn Gly Ile Thr Pro Arg Arg Trp Ile Arg Phe Cys Ser
485 490 495

Pro Glu Leu Ser His Ile Ile Thr Lys Trp Leu Lys Thr Asp Gln Trp
500 505 510

Val Thr Asn Leu Glu Leu Leu Ala Asn Leu Arg Glu Phe Ala Asp Asn
515 520 525

Ser Glu Leu His Ala Glu Trp Glu Ser Ala Lys Met Ala Asn Lys Gln
530 535 540

Arg Leu Ala Gln Tyr Ile Leu His Val Thr Gly Val Ser Ile Asp Pro
545 550 555 560

Asn Ser Leu Phe Asp Ile Gln Val Lys Arg Ile His Glu Tyr Lys Arg
565 570 575

Gln Leu Leu Asn Ile Leu Gly Val Ile Tyr Arg Tyr Lys Lys Leu Lys
580 585 590

Gly Met Ser Pro Glu Glu Arg Lys Asn Thr Thr Pro Arg Thr Val Met
595 600 605

Ile Gly Gly Lys Ala Phe Ala Thr Tyr Thr Asn Ala Lys Arg Ile Val
610 615 620

Lys Leu Val Thr Asp Val Gly Asp Val Val Asn Ser Asp Pro Asp Val
625 630 635 640

Asn Asp Tyr Leu Lys Val Val Phe Val Pro Asn Tyr Asn Val Ser Val
645 650 655

Ala Glu Met Leu Ile Pro Gly Ser Glu Leu Ser Gln His Ile Ser Thr
660 665 670

Ala Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Leu Asn
675 680 685

Gly Cys Leu Ile Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg
690 695 700

Glu Glu Ile Gly Glu Asp Asn Phe Phe Leu Phe Gly Ala Thr Ala Asp
705 710 715 720

Glu Val Pro Gln Leu Arg Lys Asp Arg Glu Asn Gly Leu Phe Lys Pro
725 730 735

Asp Pro Arg Phe Glu Glu Ala Lys Gln Phe Ile Arg Ser Gly Ala Phe
740 745 750

Gly Thr Tyr Asp Tyr Asn Pro Leu Leu Glu Ser Leu Glu Gly Asn Ser
755 760 765

Gly Tyr Gly Arg Gly Asp Tyr Phe Leu Val Gly His Asp Phe Pro Ser
770 775 780

Tyr Met Asp Ala Gln Ala Arg Val Asp Glu Ala Tyr Lys Asp Arg Lys
785 790 795 800

Arg Trp Ile Lys Met Ser Ile Leu Ser Thr Ser Gly Ser Gly Lys Phe
805 810 815

Ser Ser Asp Arg Thr Ile Ser Gln Tyr Ala Lys Glu Ile Trp Asn Ile
820 825 830

Ala Glu Cys Arg Val Pro
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ttg cca gcc tgg ggt tat gga ttg agg tac aaa cat gga ctg ttc aag 97
Leu Pro Ala Trp Gly Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys
20 25 30

caa cgt atc acc aaa gca gga caa gag gag att gct gaa gat tgg ctg 145
Gln Arg Ile Thr Lys Ala Gly Gln Glu Glu Ile Ala Glu Asp Trp Leu
35 40 45

gag aaa ttc agt ccc tgg gaa gtt gca agg cat gac att gtc ttc ccc 193
Glu Lys Phe Ser Pro Trp Glu Val Ala Arg His Asp Ile Val Phe Pro
50 55 60

atc aga ttt ttt ggt cac gtt gag gat cct agt ggc tcc cgg aaa 241

Ile Arg Phe Phe Gly His Val Glu Val Asp Pro Ser Gly Ser Arg Lys
65 70 75 80

tgg gtt ggt ggt gag gtc ata cag gct gtt gca tat gat gtt cct att 289
Trp Val Gly Gly Glu Val Ile Gln Ala Val Ala Tyr Asp Val Pro Ile
85 90 95

cct ggg tat aaa aca aag aat act att agt ctt cga cta tgg gaa gcc 337
Pro Gly Tyr Lys Thr Lys Asn Thr Ile Ser Leu Arg Leu Trp Glu Ala
100 105 110

aaa gcc agt gca gag gac tta aac tta tct caa ttt aat gat ggg caa 385
Lys Ala Ser Ala Glu Asp Leu Asn Leu Ser Gln Phe Asn Asp Gly Gln
115 120 125

tat gaa tct gct aca ctg ctt cat tct cgg gct cat cag att tgt gct 433
Tyr Glu Ser Ala Thr Leu Leu His Ser Arg Ala His Gln Ile Cys Ala
130 135 140

gtc ctt tac cct ggg gat gca acg gaa agt gga aaa ctt tta cga ctt 481
Val Leu Tyr Pro Gly Asp Ala Thr Glu Ser Gly Lys Leu Leu Arg Leu
145 150 155 160

aaa caa caa ttt ttg ctg tgt agt gca tct ctt cag gac atc ata ttc 529
Lys Gln Gln Phe Leu Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Phe
165 170 175

aga ttt aag gag agg aat gat ggg aag ggc act ctt gat tgg tcc aca 577
Arg Phe Lys Glu Arg Asn Asp Gly Lys Gly Thr Leu Asp Trp Ser Thr
180 185 190

ttc ccc aca aaa gtt gca gta caa ctg aat gac aca cat cct acg ctc 625
Phe Pro Thr Lys Val Ala Val Gln Leu Asn Asp Thr His Pro Thr Leu
195 200 205

tcg att ccg gag ctg atg cgg tta ttg atg gat gat gaa gga ctt gga 673
Ser Ile Pro Glu Leu Met Arg Leu Leu Met Asp Asp Glu Gly Leu Gly
210 215 220

tgg gat gaa gca tgg gat ata acc act agg aca atc gct tat aca aat 721
Trp Asp Glu Ala Trp Asp Ile Thr Thr Arg Thr Ile Ala Tyr Thr Asn
225 230 235 240

cat acc gtc cta cct gaa gca cta gaa aaa tgg tca caa gca gtc atg 769
His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Gln Ala Val Met
245 250 255

tgg aaa ctt ctt cca cgg cat atg gaa atc att gag gaa atc gac aag 817
Trp Lys Leu Leu Pro Arg His Met Glu Ile Ile Glu Glu Ile Asp Lys
260 265 270

cgg ttt att gca atg ata caa tca aag ata cct aat ctt gag agt aag 865
Arg Phe Ile Ala Met Ile Gln Ser Lys Ile Pro Asn Leu Glu Ser Lys
275 280 285

atc tct gcc ata tgc att ttg gat cac aat ccc cag aag cct gtt gtg 913
Ile Ser Ala Ile Cys Ile Leu Asp His Asn Pro Gln Lys Pro Val Val
290 295 300

cgt atg gct aat ttg tgt gtc atc tct tcg cat acg gtg aat ggt gtt 961

Arg Met Ala Asn Leu Cys Val Ile Ser Ser His Thr Val Asn Gly Val
305 310 315 320

gcc cag cta cac agt gat atc ttg aag gat gaa tta ttc atc gac tat 1009
Ala Gln Leu His Ser Asp Ile Leu Lys Asp Glu Leu Phe Ile Asp Tyr
325 330 335

gtc tct atc tgg ccc acc aaa ttc cag aac aaa acc aac ggc ata aca 1057
Val Ser Ile Trp Pro Thr Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr
340 345 350

cca cgg cgg tgg ctt agg ttt tgc aat ccc gag ctg agt gat ata atc 1105
Pro Arg Arg Trp Leu Arg Phe Cys Asn Pro Glu Leu Ser Asp Ile Ile
355 360 365

acc aag tgg tta aaa act gat gaa tgg gtg act aat ctt gat ttg ctt 1153
Thr Lys Trp Leu Lys Thr Asp Glu Trp Val Thr Asn Leu Asp Leu Leu
370 375 380

act aat ctg cgg aag ttt gct gac gat gaa caa ctc cat gct caa tgg 1201
Thr Asn Leu Arg Lys Phe Ala Asp Asp Glu Gln Leu His Ala Gln Trp
385 390 395 400

gag tct gcc aag atg gca agc aag caa cga ttg gcg cag tac ata ctg 1249
Glu Ser Ala Lys Met Ala Ser Lys Gln Arg Leu Ala Gln Tyr Ile Leu
405 410 415

cga gta acc ggt gtg cgt gtt gac cca aat aca cta ttt gac ata caa 1297
Arg Val Thr Gly Val Arg Val Asp Pro Asn Thr Leu Phe Asp Ile Gln
420 425 430

gtc aag cgc att cac gaa tac aaa agg cag ctg cta aat gta ttg ggt 1345
Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Val Leu Gly
435 440 445

gta gtc tac cgg tac aag aaa ctg aag gag atg aaa ccc gaa gag cgt 1393
Val Val Tyr Arg Tyr Lys Lys Leu Lys Glu Met Lys Pro Glu Glu Arg
450 455 460

aag aat aca aca gca cgc act gtc atg ctc ggg gga aaa gca ttt gcg 1441
Lys Asn Thr Thr Ala Arg Thr Val Met Leu Gly Gly Lys Ala Phe Ala
465 470 475 480

acc tat aca aat gca aaa agg atc atc aag ctt gtg acg gat gtt ggg 1489
Thr Tyr Thr Asn Ala Lys Arg Ile Ile Lys Leu Val Thr Asp Val Gly
485 490 495

gat gtt gtc aat agt gat cct gag gtc aat agc tat ttg aag gta gtc 1537
Asp Val Val Asn Ser Asp Pro Glu Val Asn Ser Tyr Leu Lys Val Val
500 505 510

ttt gta ccc aat tac aac gta tct gtg gca gaa gtg ctt att ccg gga 1585
Phe Val Pro Asn Tyr Asn Val Ser Val Ala Glu Val Leu Ile Pro Gly
515 520 525

agt gag ctt tca cag cac atc agc aca gct ggc 1618
Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly
530 535

<210> 32
<211> 539
<212> PRT
<213> Ipomoea batatas

<400> 32

Leu Gly Arg Leu Ala Ser Cys Phe Leu Asp Ser Met Ala Thr Leu Asn
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Leu Pro Ala Trp Gly Tyr Gly Leu Arg Tyr Lys His Gly Leu Phe Lys
20 25 30

Gln Arg Ile Thr Lys Ala Gly Gln Glu Glu Ile Ala Glu Asp Trp Leu
35 40 45

Glu Lys Phe Ser Pro Trp Glu Val Ala Arg His Asp Ile Val Phe Pro
50 55 60

Ile Arg Phe Phe Gly His Val Glu Val Asp Pro Ser Gly Ser Arg Lys
65 70 75 80

Trp Val Gly Gly Glu Val Ile Gln Ala Val Ala Tyr Asp Val Pro Ile
85 90 95

Pro Gly Tyr Lys Thr Lys Asn Thr Ile Ser Leu Arg Leu Trp Glu Ala
100 105 110

Lys Ala Ser Ala Glu Asp Leu Asn Leu Ser Gln Phe Asn Asp Gly Gln
115 120 125

Tyr Glu Ser Ala Thr Leu Leu His Ser Arg Ala His Gln Ile Cys Ala
130 135 140

Val Leu Tyr Pro Gly Asp Ala Thr Glu Ser Gly Lys Leu Leu Arg Leu
145 150 155 160

Lys Gln Gln Phe Leu Leu Cys Ser Ala Ser Leu Gln Asp Ile Ile Phe
165 170 175

Arg Phe Lys Glu Arg Asn Asp Gly Lys Gly Thr Leu Asp Trp Ser Thr
180 185 190

Phe Pro Thr Lys Val Ala Val Gln Leu Asn Asp Thr His Pro Thr Leu
195 200 205

Ser Ile Pro Glu Leu Met Arg Leu Leu Met Asp Asp Glu Gly Leu Gly

210

215

220

Trp Asp Glu Ala Trp Asp Ile Thr Thr Arg Thr Ile Ala Tyr Thr Asn
225 230 235 240

His Thr Val Leu Pro Glu Ala Leu Glu Lys Trp Ser Gln Ala Val Met
245 250 255

Trp Lys Leu Leu Pro Arg His Met Glu Ile Ile Glu Glu Ile Asp Lys
260 265 270

Arg Phe Ile Ala Met Ile Gln Ser Lys Ile Pro Asn Leu Glu Ser Lys
275 280 285

Ile Ser Ala Ile Cys Ile Leu Asp His Asn Pro Gln Lys Pro Val Val
290 295 300

Arg Met Ala Asn Leu Cys Val Ile Ser Ser His Thr Val Asn Gly Val
305 310 315 320

Ala Gln Leu His Ser Asp Ile Leu Lys Asp Glu Leu Phe Ile Asp Tyr
325 330 335

Val Ser Ile Trp Pro Thr Lys Phe Gln Asn Lys Thr Asn Gly Ile Thr
340 345 350

Pro Arg Arg Trp Leu Arg Phe Cys Asn Pro Glu Leu Ser Asp Ile Ile
355 360 365

Thr Lys Trp Leu Lys Thr Asp Glu Trp Val Thr Asn Leu Asp Leu Leu
370 375 380

Thr Asn Leu Arg Lys Phe Ala Asp Asp Glu Gln Leu His Ala Gln Trp
385 390 395 400

Glu Ser Ala Lys Met Ala Ser Lys Gln Arg Leu Ala Gln Tyr Ile Leu
405 410 415

Arg Val Thr Gly Val Arg Val Asp Pro Asn Thr Leu Phe Asp Ile Gln
420 425 430

Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu Leu Asn Val Leu Gly
435 440 445

Val Val Tyr Arg Tyr Lys Lys Leu Lys Glu Met Lys Pro Glu Glu Arg

450 455 460
 Lys Asn Thr Thr Ala Arg Thr Val Met Leu Gly Gly Lys Ala Phe Ala
 465 470 475 480

 Thr Tyr Thr Asn Ala Lys Arg Ile Ile Lys Leu Val Thr Asp Val Gly
 485 490 495

 Asp Val Val Asn Ser Asp Pro Glu Val Asn Ser Tyr Leu Lys Val Val
 500 505 510

 Phe Val Pro Asn Tyr Asn Val Ser Val Ala Glu Val Leu Ile Pro Gly
 515 520 525

 Ser Glu Leu Ser Gln His Ile Ser Thr Ala Gly
 530 535

 <210> 33
 <211> 2754
 <212> DNA
 <213> Artificial sequence

 <220>
 <223> a mutant of a potato type L alpha-glucan phosphorylase

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 <221> CDS
 <222> (1)..(2751)

 <220>
 <221> mat_peptide
 <222> (4)..(2751)

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 -1 1 5 10 15

 gag agc gac ctg agt tct ttt gct cct gat gcc gca tct att acc tca 96
 Glu Ser Asp Leu Ser Ser Phe Ala Pro Asp Ala Ala Ser Ile Thr Ser
 20 25 30

 agt atc aaa tac cat gca gaa ctc aca cct gta ttc tct cct gaa agg 144
 Ser Ile Lys Tyr His Ala Glu Leu Thr Pro Val Phe Ser Pro Glu Arg
 35 40 45

 ttt gag ctc cct aag gca ttc ttt gca aca gct caa agt gtt cgt gat 192
 Phe Glu Leu Pro Lys Ala Phe Phe Ala Thr Ala Gln Ser Val Arg Asp
 50 55 60

 tcg ctc ctt att aat tgg aat gct acg tat gat att tat gaa aag ctg 240
 Ser Leu Leu Ile Asn Trp Asn Ala Thr Tyr Asp Ile Tyr Glu Lys Leu
 65 70 75

aac atg aag caa gcg tac tat cta tcc atg gaa ttt ctg cag ggt aga 288
Asn Met Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly Arg
80 85 90 95

gca ttg tta aat gca att ggt aat ctg gag ctt act ggt gca ttt gcg 336
Ala Leu Leu Asn Ala Ile Gly Asn Leu Glu Leu Thr Gly Ala Phe Ala
100 105 110

gaa gct ttg aaa aac ctt ggt cac aat cta gaa aat gtg gct tct cag 384
Glu Ala Leu Lys Asn Leu Gly His Asn Leu Glu Asn Val Ala Ser Gln
115 120 125

gaa cca gat gct gct ctt gga agt ggg ggt ttg gga cgg ctt gct tcc 432
Glu Pro Asp Ala Ala Leu Gly Ser Gly Gly Leu Gly Arg Leu Ala Ser
130 135 140

tgt ttt ctg gac tct ttg gca aca cta aac tac cca gca tgg ggc tat 480
Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala Trp Gly Tyr
145 150 155

gga ctt agg tac aag tat ggt tta ttt aag caa cgg att aca aaa gat 528
Gly Leu Arg Tyr Lys Tyr Gly Leu Phe Lys Gln Arg Ile Thr Lys Asp
160 165 170 175

ggt cag gag gag gtg gct gaa gat tgg ctt gaa att ggc agt cca tgg 576
Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Ile Gly Ser Pro Trp
180 185 190

gaa gtt gtg agg aat gat gtt tca tat cct atc aaa ttc tat gga aaa 624
Glu Val Val Arg Asn Asp Val Ser Tyr Pro Ile Lys Phe Tyr Gly Lys
195 200 205

gtc tct aca gga tca gat gga aag agg tat tgg att ggt gga gag gat 672
Val Ser Thr Gly Ser Asp Gly Lys Arg Tyr Trp Ile Gly Gly Glu Asp
210 215 220

ata aag gca gtt gcg tat gat gtt ccc ata cca ggg tat aag acc aga 720
Ile Lys Ala Val Ala Tyr Asp Val Pro Ile Pro Gly Tyr Lys Thr Arg
225 230 235

acc aca atc agc ctt cga ctg tgg tct aca cag gtt cca tca gcg gat 768
Thr Thr Ile Ser Leu Arg Leu Trp Ser Thr Gln Val Pro Ser Ala Asp
240 245 250 255

ttt gat tta tct gct ttc aat gct gga gag cac acc aaa gca tgt gaa 816
Phe Asp Leu Ser Ala Phe Asn Ala Gly Glu His Thr Lys Ala Cys Glu
260 265 270

gcc caa gca aac gct gag aag ata tgt tac ata ctc tac cct ggg gat 864
Ala Gln Ala Asn Ala Glu Lys Ile Cys Tyr Ile Leu Tyr Pro Gly Asp
275 280 285

gaa tca gag gag gga aag atc ctt cgg ttg aag caa caa tat acc tta 912
Glu Ser Glu Glu Gly Lys Ile Leu Arg Leu Lys Gln Gln Tyr Thr Leu
290 295 300

tgc tcg gct tct ctc caa gat att att tct cga ttt gag agg aga tca 960
Cys Ser Ala Ser Leu Gln Asp Ile Ile Ser Arg Phe Glu Arg Arg Ser
305 310 315

ggt gat cgt att aag tgg gaa gag ttt cct gaa aaa gtt gct gtg cag 1008
 Gly Asp Arg Ile Lys Trp Glu Glu Phe Pro Glu Lys Val Ala Val Gln
 320 325 330 335

atg aat gac act cac cct aca ctt tgt atc cct gag ctg atg aga ata 1056
 Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu Met Arg Ile
 340 345 350

ttg ata gat ctg aag ggc ttg aat tgg aat gaa gct tgg aat att act 1104
 Leu Ile Asp Leu Lys Gly Leu Asn Trp Asn Glu Ala Trp Asn Ile Thr
 355 360 365

caa aga act gtg gcc tac aca aac cat act gtt ttg cct gag gca ctg 1152
 Gln Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu
 370 375 380

gag aaa tgg agt tat gaa ttg atg cag aaa ctg ctt ccc aga cat gtc 1200
 Glu Lys Trp Ser Tyr Glu Leu Met Gln Lys Leu Leu Pro Arg His Val
 385 390 395

gaa atc att gag gcg att gac gag gag ctg gta cat gaa att gta tta 1248
 Glu Ile Ile Glu Ala Ile Asp Glu Glu Leu Val His Glu Ile Val Leu
 400 405 410 415

aaa tat ggt tca atg gat ctg aac aaa ttg gag gaa aag ttg act aca 1296
 Lys Tyr Gly Ser Met Asp Leu Asn Lys Leu Glu Glu Lys Leu Thr Thr
 420 425 430

atg aga atc tta gaa aat ttt gat ctt ccc agt cct gtt gct gaa tta 1344
 Met Arg Ile Leu Glu Asn Phe Asp Leu Pro Ser Pro Val Ala Glu Leu
 435 440 445

ttt att aag cct gaa atc tca gtt gat gat gat act gaa aca gta gaa 1392
 Phe Ile Lys Pro Glu Ile Ser Val Asp Asp Asp Thr Glu Thr Val Glu
 450 455 460

gtc cat gac aaa gtt gaa gct tcc gat aaa gtt gtg act aat gat gaa 1440
 Val His Asp Lys Val Glu Ala Ser Asp Lys Val Val Thr Asn Asp Glu
 465 470 475

gat gac act ggt aag aaa act agt gtg aag ata gaa gca gct gca gaa 1488
 Asp Asp Thr Gly Lys Lys Thr Ser Val Lys Ile Glu Ala Ala Ala Glu
 480 485 490 495

aaa gac att gac aag aaa act ccc gtg agt ccg gaa cca gct gca gaa 1536
 Lys Asp Ile Asp Lys Lys Thr Pro Val Ser Pro Glu Pro Ala Val Ile
 500 505 510

cca cct aag aag gta cgc atg gcc aac ttg tgt gtt gtg ggc ggc cat 1584
 Pro Pro Lys Lys Val Arg Met Ala Asn Leu Cys Val Val Gly Gly His
 515 520 525

gct gtt aat gga gtt gct gag atc cat agt gaa att gtg aag gag gag 1632
 Ala Val Asn Gly Val Ala Glu Ile His Ser Glu Ile Val Lys Glu Glu
 530 535 540

gtt ttc aat gac ttc tat gag ctc tgg ccg gaa aag ttc caa aac aaa 1680
 Val Phe Asn Asp Phe Tyr Glu Leu Trp Pro Glu Lys Phe Gln Asn Lys
 545 550 555

aca aat gga gtg act cca aga aga tgg att cgt ttc tgc aat cct cct 1728
Thr Asn Gly Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn Pro Pro
560 565 570 575

ctt agt gcc atc ata act aag tgg act ggt aca gag gat tgg gtc ctg 1776
Leu Ser Ala Ile Ile Thr Lys Trp Thr Gly Thr Glu Asp Trp Val Leu
580 585 590

aaa act gaa aag ttg gca gaa ttg cag aag ttt gct gat aat gaa gat 1824
Lys Thr Glu Lys Leu Ala Glu Leu Gln Lys Phe Ala Asp Asn Glu Asp
595 600 605

ctt caa aat gag tgg agg gaa gca aaa agg agc aac aag att aaa gtt 1872
Leu Gln Asn Glu Trp Arg Glu Ala Lys Arg Ser Asn Lys Ile Lys Val
610 615 620

gtc tcc ttt ctc aaa gaa aag aca ggg tat tct gtt gtc cca gat gca 1920
Val Ser Phe Leu Lys Glu Lys Thr Gly Tyr Ser Val Val Pro Asp Ala
625 630 635

atg ttt gat att cag gta aaa cgc att cat gag tac aag cga caa ctg 1968
Met Phe Asp Ile Gln Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu
640 645 650 655

tta aat atc ttc ggc atc gtt tat cgg tat aag aag atg aaa gaa atg 2016
Leu Asn Ile Phe Gly Ile Val Tyr Arg Tyr Lys Lys Met Lys Glu Met
660 665 670

aca gct gca gaa aga aag act aac ttc gtt cct cga gta tgc ata ttt 2064
Thr Ala Ala Glu Arg Lys Thr Asn Phe Val Pro Arg Val Cys Ile Phe
675 680 685

ggg gga aaa gct ttt gcc aca tat gtg caa gcc aag agg att gta aaa 2112
Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln Ala Lys Arg Ile Val Lys
690 695 700

ttt atc ata gat gtt ggt gct act ata aat cat gat cca gaa atc ggt 2160
Phe Ile Ile Asp Val Gly Ala Thr Ile Asn His Asp Pro Glu Ile Gly
705 710 715

gat ctg ttg aag gta gtc ttt gtg cca gat tac aat gtc agt gtt gct 2208
Asp Leu Leu Lys Val Val Phe Val Pro Asp Tyr Asn Val Ser Val Ala
720 725 730 735

gaa ttg cta att cct gct agc gat cta tca gaa cat atc agt acg gct 2256
Glu Leu Leu Ile Pro Ala Ser Asp Leu Ser Glu His Ile Ser Thr Ala
740 745 750

gga atg gag gcc agt gga acc agt aat atg aag ttt gca atg aat ggt 2304
Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Met Asn Gly
755 760 765

tgt atc caa att ggt aca ttg gat ggc gct aat gtt gaa ata agg gaa 2352
Cys Ile Gln Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu
770 775 780

gag gtt gga gaa gaa aac ttc ttt ctc ttt ggt gct caa gct cat gaa 2400
Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Gln Ala His Glu
785 790 795

att gca ggg ctt aga aaa gaa aga gct gac gga aag ttt gta cct gat 2448
Ile Ala Gly Leu Arg Lys Glu Arg Ala Asp Gly Lys Phe Val Pro Asp
800 805 810 815

gaa cgt ttt gaa gag gtg aag gaa ttt gtt aga agc ggt gct ttt ggc 2496
Glu Arg Phe Glu Glu Val Lys Glu Phe Val Arg Ser Gly Ala Phe Gly
820 825 830

tct tat aac tat gat gac cta att gga tcg ttg gaa gga aat gaa ggt 2544
Ser Tyr Asn Tyr Asp Asp Leu Ile Gly Ser Leu Glu Gly Asn Glu Gly
835 840 845

ttt ggc cgt gct gac tat ttc ctt gtg ggc aag gac ttc ccc agt tac 2592
Phe Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro Ser Tyr
850 855 860

ata gaa tgc caa gag aaa gtt gat gag gca tat cgc gac cag aaa agg 2640
Ile Glu Cys Gln Glu Lys Val Asp Glu Ala Tyr Arg Asp Gln Lys Arg
865 870 875

tgg aca acg atg tca atc ttg aat aca gcg gga tcg tac aag ttc agc 2688
Trp Thr Thr Met Ser Ile Leu Asn Thr Ala Gly Ser Tyr Lys Phe Ser
880 885 890 895

agt gac aga aca atc cat gaa tat gcc aaa gac att tgg aac att gaa 2736
Ser Asp Arg Thr Ile His Glu Tyr Ala Lys Asp Ile Trp Asn Ile Glu
900 905 910

gct gtg gaa ata gca taa 2754
Ala Val Glu Ile Ala
915

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<211> 917
<212> PRT
<213> Artificial sequence

<220>
<223> Synthetic Construct

<400> 34

Met Thr Leu Ser Glu Lys Ile His His Pro Ile Thr Glu Gln Gly Gly
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Glu Ser Asp Leu Ser Ser Phe Ala Pro Asp Ala Ala Ser Ile Thr Ser
20 25 30

Ser Ile Lys Tyr His Ala Glu Leu Thr Pro Val Phe Ser Pro Glu Arg
35 40 45

Phe Glu Leu Pro Lys Ala Phe Phe Ala Thr Ala Gln Ser Val Arg Asp
50 55 60

Ser Leu Leu Ile Asn Trp Asn Ala Thr Tyr Asp Ile Tyr Glu Lys Leu
65 70 75

Asn Met Lys Gln Ala Tyr Tyr Leu Ser Met Glu Phe Leu Gln Gly Arg
80 85 90 95

Ala Leu Leu Asn Ala Ile Gly Asn Leu Glu Leu Thr Gly Ala Phe Ala
100 105 110

Glu Ala Leu Lys Asn Leu Gly His Asn Leu Glu Asn Val Ala Ser Gln
115 120 125

Glu Pro Asp Ala Ala Leu Gly Ser Gly Gly Leu Gly Arg Leu Ala Ser
130 135 140

Cys Phe Leu Asp Ser Leu Ala Thr Leu Asn Tyr Pro Ala Trp Gly Tyr
145 150 155

Gly Leu Arg Tyr Lys Tyr Gly Leu Phe Lys Gln Arg Ile Thr Lys Asp
160 165 170 175

Gly Gln Glu Glu Val Ala Glu Asp Trp Leu Glu Ile Gly Ser Pro Trp
180 185 190

Glu Val Val Arg Asn Asp Val Ser Tyr Pro Ile Lys Phe Tyr Gly Lys
195 200 205

Val Ser Thr Gly Ser Asp Gly Lys Arg Tyr Trp Ile Gly Gly Glu Asp
210 215 220

Ile Lys Ala Val Ala Tyr Asp Val Pro Ile Pro Gly Tyr Lys Thr Arg
225 230 235

Thr Thr Ile Ser Leu Arg Leu Trp Ser Thr Gln Val Pro Ser Ala Asp
240 245 250 255

Phe Asp Leu Ser Ala Phe Asn Ala Gly Glu His Thr Lys Ala Cys Glu
260 265 270

Ala Gln Ala Asn Ala Glu Lys Ile Cys Tyr Ile Leu Tyr Pro Gly Asp
275 280 285

Glu Ser Glu Glu Gly Lys Ile Leu Arg Leu Lys Gln Gln Tyr Thr Leu
290 295 300

Cys Ser Ala Ser Leu Gln Asp Ile Ile Ser Arg Phe Glu Arg Arg Ser
305 310 315

Gly Asp Arg Ile Lys Trp Glu Glu Phe Pro Glu Lys Val Ala Val Gln
320 325 330 335

Met Asn Asp Thr His Pro Thr Leu Cys Ile Pro Glu Leu Met Arg Ile
340 345 350

Leu Ile Asp Leu Lys Gly Leu Asn Trp Asn Glu Ala Trp Asn Ile Thr
355 360 365

Gln Arg Thr Val Ala Tyr Thr Asn His Thr Val Leu Pro Glu Ala Leu
370 375 380

Glu Lys Trp Ser Tyr Glu Leu Met Gln Lys Leu Leu Pro Arg His Val
385 390 395

Glu Ile Ile Glu Ala Ile Asp Glu Glu Leu Val His Glu Ile Val Leu
400 405 410 415

Lys Tyr Gly Ser Met Asp Leu Asn Lys Leu Glu Glu Lys Leu Thr Thr
420 425 430

Met Arg Ile Leu Glu Asn Phe Asp Leu Pro Ser Pro Val Ala Glu Leu
435 440 445

Phe Ile Lys Pro Glu Ile Ser Val Asp Asp Asp Thr Glu Thr Val Glu
450 455 460

Val His Asp Lys Val Glu Ala Ser Asp Lys Val Val Thr Asn Asp Glu
465 470 475

Asp Asp Thr Gly Lys Lys Thr Ser Val Lys Ile Glu Ala Ala Ala Glu
480 485 490 495

Lys Asp Ile Asp Lys Lys Thr Pro Val Ser Pro Glu Pro Ala Val Ile
500 505 510

Pro Pro Lys Lys Val Arg Met Ala Asn Leu Cys Val Val Gly Gly His
515 520 525

Ala Val Asn Gly Val Ala Glu Ile His Ser Glu Ile Val Lys Glu Glu
530 535 540

Val Phe Asn Asp Phe Tyr Glu Leu Trp Pro Glu Lys Phe Gln Asn Lys
545 550 555

Thr Asn Gly Val Thr Pro Arg Arg Trp Ile Arg Phe Cys Asn Pro Pro
560 565 570 575

Leu Ser Ala Ile Ile Thr Lys Trp Thr Gly Thr Glu Asp Trp Val Leu
580 585 590

Lys Thr Glu Lys Leu Ala Glu Leu Gln Lys Phe Ala Asp Asn Glu Asp
595 600 605

Leu Gln Asn Glu Trp Arg Glu Ala Lys Arg Ser Asn Lys Ile Lys Val
610 615 620

Val Ser Phe Leu Lys Glu Lys Thr Gly Tyr Ser Val Val Pro Asp Ala
625 630 635

Met Phe Asp Ile Gln Val Lys Arg Ile His Glu Tyr Lys Arg Gln Leu
640 645 650 655

Leu Asn Ile Phe Gly Ile Val Tyr Arg Tyr Lys Lys Met Lys Glu Met
660 665 670

Thr Ala Ala Glu Arg Lys Thr Asn Phe Val Pro Arg Val Cys Ile Phe
675 680 685

Gly Gly Lys Ala Phe Ala Thr Tyr Val Gln Ala Lys Arg Ile Val Lys
690 695 700

Phe Ile Ile Asp Val Gly Ala Thr Ile Asn His Asp Pro Glu Ile Gly
705 710 715

Asp Leu Leu Lys Val Val Phe Val Pro Asp Tyr Asn Val Ser Val Ala
720 725 730 735

Glu Leu Leu Ile Pro Ala Ser Asp Leu Ser Glu His Ile Ser Thr Ala
740 745 750

Gly Met Glu Ala Ser Gly Thr Ser Asn Met Lys Phe Ala Met Asn Gly
755 760 765

Cys Ile Gln Ile Gly Thr Leu Asp Gly Ala Asn Val Glu Ile Arg Glu
770 775 780

Glu Val Gly Glu Glu Asn Phe Phe Leu Phe Gly Ala Gln Ala His Glu
785 790 795

Ile Ala Gly Leu Arg Lys Glu Arg Ala Asp Gly Lys Phe Val Pro Asp
800 805 810 815

Glu Arg Phe Glu Glu Val Lys Glu Phe Val Arg Ser Gly Ala Phe Gly
820 825 830

Ser Tyr Asn Tyr Asp Asp Leu Ile Gly Ser Leu Glu Gly Asn Glu Gly
835 840 845

Phe Gly Arg Ala Asp Tyr Phe Leu Val Gly Lys Asp Phe Pro Ser Tyr
850 855 860

Ile Glu Cys Gln Glu Lys Val Asp Glu Ala Tyr Arg Asp Gln Lys Arg
865 870 875

Trp Thr Thr Met Ser Ile Leu Asn Thr Ala Gly Ser Tyr Lys Phe Ser
880 885 890 895

Ser Asp Arg Thr Ile His Glu Tyr Ala Lys Asp Ile Trp Asn Ile Glu
900 905 910

Ala Val Glu Ile Ala
915

<210> 35
<211> 797
<212> PRT
<213> Escherichia coli

<400> 35

Met Ser Gln Pro Ile Phe Asn Asp Lys Gln Phe Gln Glu Ala Leu Ser
1 5 10 15

Arg Gln Trp Gln Arg Tyr Gly Leu Asn Ser Ala Ala Glu Met Thr Pro
20 25 30

Arg Gln Trp Trp Leu Ala Val Ser Glu Ala Leu Ala Glu Met Leu Arg
35 40 45

Ala Gln Pro Phe Ala Lys Pro Val Ala Asn Gln Arg His Val Asn Tyr
50 55 60

Ile Ser Met Glu Phe Leu Ile Gly Arg Leu Thr Gly Asn Asn Leu Leu

65 70 75 80

Asn Leu Gly Trp Tyr Gln Asp Val Gln Asp Ser Leu Lys Ala Tyr Asp
85 90 95

Ile Asn Leu Thr Asp Leu Leu Glu Glu Ile Asp Pro Ala Leu Gly
100 105 110

Asn Gly Gly Leu Gly Arg Leu Ala Ala Cys Phe Leu Asp Ser Met Ala
115 120 125

Thr Val Gly Gln Ser Ala Thr Gly Tyr Gly Leu Asn Tyr Gln Tyr Gly
130 135 140

Leu Phe Arg Gln Ser Phe Val Asp Gly Lys Gln Val Glu Ala Pro Asp
145 150 155 160

Asp Trp His Arg Ser Asn Tyr Pro Trp Phe Arg His Asn Glu Ala Leu
165 170 175

Asp Val Gln Val Gly Ile Gly Gly Lys Val Thr Lys Asp Gly Arg Trp
180 185 190

Glu Pro Glu Phe Thr Ile Thr Gly Gln Ala Trp Asp Leu Pro Val Val
195 200 205

Gly Tyr Arg Asn Gly Val Ala Gln Pro Leu Arg Leu Trp Gln Ala Thr
210 215 220

His Ala His Pro Phe Asp Leu Thr Lys Phe Asn Asp Gly Asp Phe Leu
225 230 235 240

Arg Ala Glu Gln Gln Gly Ile Asn Ala Glu Lys Leu Thr Lys Val Leu
245 250 255

Tyr Pro Asn Asp Asn His Thr Ala Gly Lys Lys Leu Arg Leu Met Gln
260 265 270

Gln Tyr Phe Gln Cys Ala Cys Ser Val Ala Asp Ile Leu Arg Arg His
275 280 285

His Leu Ala Gly Arg Glu Leu His Glu Leu Ala Asp Tyr Glu Val Ile
290 295 300

Gln Leu Asn Asp Thr His Pro Thr Ile Ala Ile Pro Glu Leu Leu Arg

305

310

315

320

Val Leu Ile Asp Glu His Gln Met Ser Trp Asp Asp Ala Trp Ala Ile
325 330 335

Thr Ser Lys Thr Phe Ala Tyr Thr Asn His Thr Leu Met Pro Glu Ala
340 345 350

Leu Glu Arg Trp Asp Val Lys Leu Val Lys Gly Leu Leu Pro Arg His
355 360 365

Met Gln Ile Ile Asn Glu Ile Asn Thr Arg Phe Lys Thr Leu Val Glu
370 375 380

Lys Thr Trp Pro Gly Asp Glu Lys Val Trp Ala Lys Leu Ala Val Val
385 390 395 400

His Asp Lys Gln Val His Met Ala Asn Leu Cys Val Val Gly Gly Phe
405 410 415

Ala Val Asn Gly Val Ala Ala Leu His Ser Asp Leu Val Val Lys Asp
420 425 430

Leu Phe Pro Glu Tyr His Gln Leu Trp Pro Asn Lys Phe His Asn Val
435 440 445

Thr Asn Gly Ile Thr Pro Arg Arg Trp Ile Lys Gln Cys Asn Pro Ala
450 455 460

Leu Ala Ala Leu Leu Asp Lys Ser Leu Gln Lys Glu Trp Ala Asn Asp
465 470 475 480

Leu Asp Gln Leu Ile Asn Leu Val Lys Leu Ala Asp Asp Ala Lys Phe
485 490 495

Arg Asp Leu Tyr Arg Val Ile Lys Gln Ala Asn Lys Val Arg Leu Ala
500 505 510

Glu Phe Val Lys Val Arg Thr Gly Ile Asp Ile Asn Pro Gln Ala Ile
515 520 525

Phe Asp Ile Gln Ile Lys Arg Leu His Glu Tyr Lys Arg Gln His Leu
530 535 540

Asn Leu Leu His Ile Leu Ala Leu Tyr Lys Glu Ile Arg Glu Asn Pro

545 550 555 560

Gln Ala Asp Arg Val Pro Arg Val Phe Leu Phe Gly Ala Lys Ala Ala
565 570 575

Pro Gly Tyr Tyr Leu Ala Lys Asn Ile Ile Phe Ala Ile Asn Lys Val
580 585 590

Ala Asp Val Ile Asn Asn Asp Pro Leu Val Gly Asp Lys Leu Lys Val
595 600 605

Val Phe Leu Pro Asp Tyr Cys Val Ser Ala Ala Glu Lys Leu Ile Pro
610 615 620

Ala Ala Asp Ile Ser Glu Gln Ile Ser Thr Ala Gly Lys Glu Ala Ser
625 630 635 640

Gly Thr Gly Asn Met Lys Leu Ala Leu Asn Gly Ala Leu Thr Val Gly
645 650 655

Thr Leu Asp Gly Ala Asn Val Glu Ile Ala Glu Lys Val Gly Glu Glu
660 665 670

Asn Ile Phe Ile Phe Gly His Thr Val Lys Gln Val Lys Ala Ile Leu
675 680 685

Ala Lys Gly Tyr Asp Pro Val Lys Trp Arg Lys Lys Asp Lys Val Leu
690 695 700

Asp Ala Val Leu Lys Glu Leu Glu Ser Gly Lys Tyr Ser Asp Gly Asp
705 710 715 720

Lys His Ala Phe Asp Gln Met Leu His Ser Ile Gly Lys Gln Gly Gly
725 730 735

Asp Pro Tyr Leu Val Met Ala Asp Phe Ala Ala Tyr Val Glu Ala Gln
740 745 750

Lys Gln Val Asp Val Leu Tyr Arg Asp Gln Glu Ala Trp Thr Arg Ala
755 760 765

Ala Ile Leu Asn Thr Ala Arg Cys Gly Met Phe Ser Ser Asp Arg Ser
770 775 780

Ile Arg Asp Tyr Gln Ala Arg Ile Trp Gln Ala Lys Arg

785

790

795

<210> 36
<211> 37
<212> DNA
<213> Artificial sequence

<220>
<223> sequence of connection portion of plasmid and gene

<400> 36
acccaaatcg ataggaggaa aacatatgac cttgagt 37

<210> 37
<211> 38
<212> DNA
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<220>
<223> sequence of connection portion of plasmid and gene

<400> 37
gcataagagg gggaaagtgaa tgaaaaggta cttcggg 38

<210> 38
<211> 41
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<220>
<223> primer sequence

<400> 38
aaatcgatag gaggaaaaca tatgaccctt agtgagaaaa t 41

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<211> 29
<212> DNA
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<220>
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<400> 39
gaaggtacct tttcattcac ttccccctc 29

<210> 40
<211> 32
<212> DNA
<213> Artificial sequence

<220>
<223> primer sequence

<400> 40

ttcggatcct caccttgagt gagaaaattc ac 32

<210> 41
<211> 29
<212> DNA
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<220>
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<400> 41
ttcggatcct tttcattcac ttcccccctc 29

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<220>
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gagaaaatct c 71

<210> 43
<211> 59
<212> DNA
<213> Artificial sequence

<220>
<223> primer sequence

<400> 43
gaaggtacct tagggaacag gacaagcctc aatgttccaa atctttgg catactgag 59

<210> 44
<211> 9
<212> PRT
<213> Solanum tuberosum

<400> 44

His Ala Glu Phe Thr Pro Val Phe Ser
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<210> 45
<211> 9
<212> PRT
<213> Oryza sativa

<400> 45

His Ala Gln Tyr Ser Pro His Phe Ser

<210> 46
<211> 8
<212> PRT
<213> Solanum tuberosum

<400> 46

Ala Leu Gly Asn Gly Gly Leu Gly
1 5

<210> 47
<211> 9
<212> PRT
<213> Solanum tuberosum

<400> 47

Arg Ile Val Lys Phe Ile Thr Asp Val
1 5

<210> 48
<211> 9
<212> PRT
<213> Oryza sativa

<400> 48

Arg Ile Val Lys Leu Val Asn Asp Val
1 5